AS-Interface Overview..... 216

Communication & Networking

IDEC

www.IDEC.com/communication

AS-Interface Overview
(Actuator Sensor Interface)

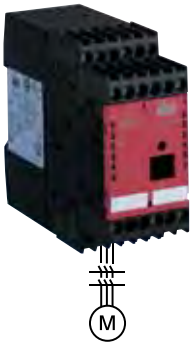
MicroSmart
Pentra

See PLC section for more information.

73W

145W

Visit www.IDEC.com/powersupply



SX5A AS-Interface Safety
Contact IDEC for more information.

AS-Interface Flat
Cable Connector

SX5A AS-Interface I/O modules

4 inputs
2 inputs/2 outputs

4 inputs/3 outputs

4 inputs
4 inputs/3 outputs

Contact IDEC for more information

SX5A AS-Interface Safety Communication
Terminal (Safety Slave)

Emergency Stop
Switch Box

Safety Interlock Switches
Contact IDEC for more information

IDEC SmartRelay
(See PLC section for more information)

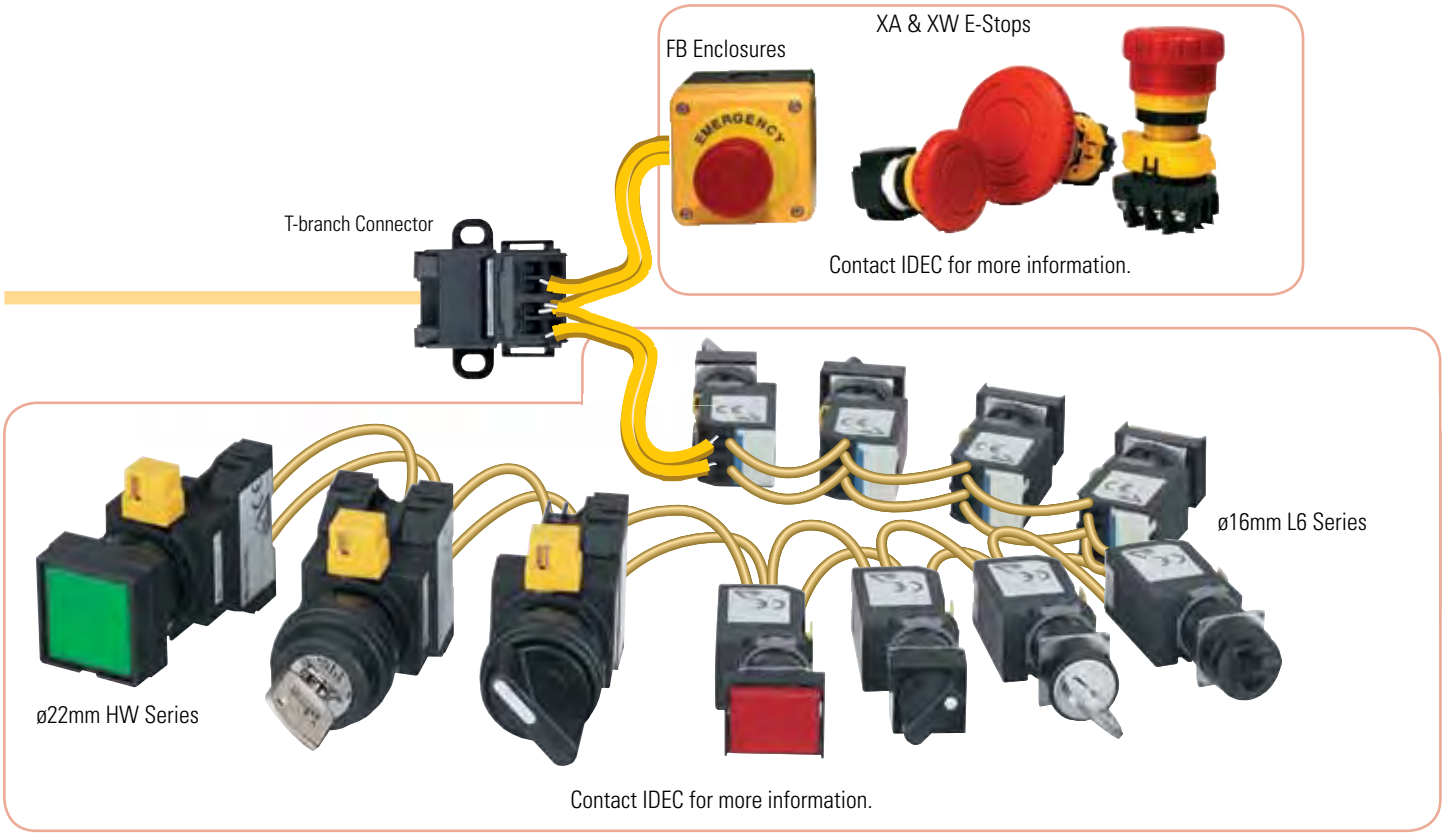
Link to the world and reduce wiring at the same time!

SwitchNet Control Units directly connect to an AS-Interface network

Panels can be built with substantially less wiring at a lower total cost.

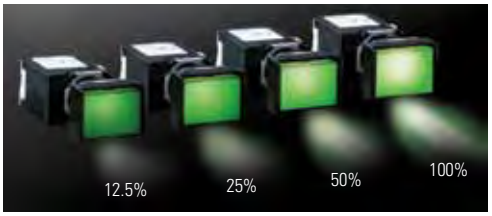
- Signals and power are carried through two wires.
- A maximum of 62 switches and pilot lights can be connected. The wire length can be extended to 300m by using two repeaters.
- Spring clamp terminals save wiring time.

Each control switch or pilot light contains a communication chip (AS-Interface Ver. 2.1).



Pilot lights & Illuminated Pushbuttons Brightness Control

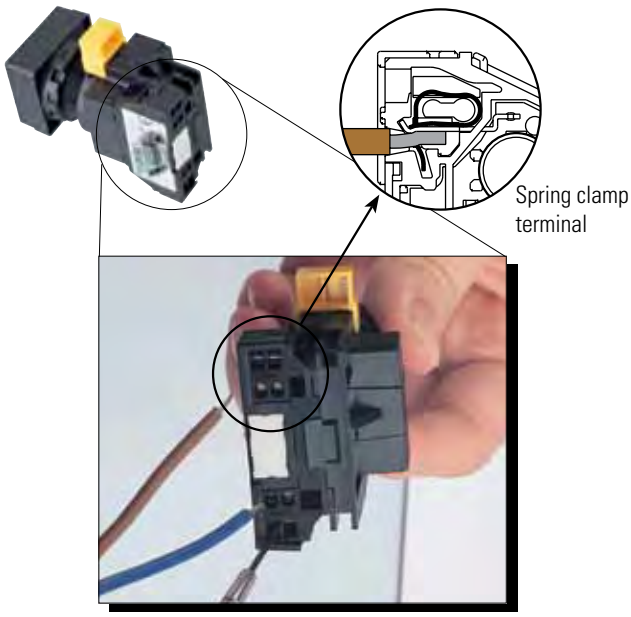
Illumination can be controlled at four levels according to a command from the AS-Interface master. Dynamic displays and energy savings are possible.



L6 Pilot Lights
See Switch & Pilot Light section.

Easy & Flexible

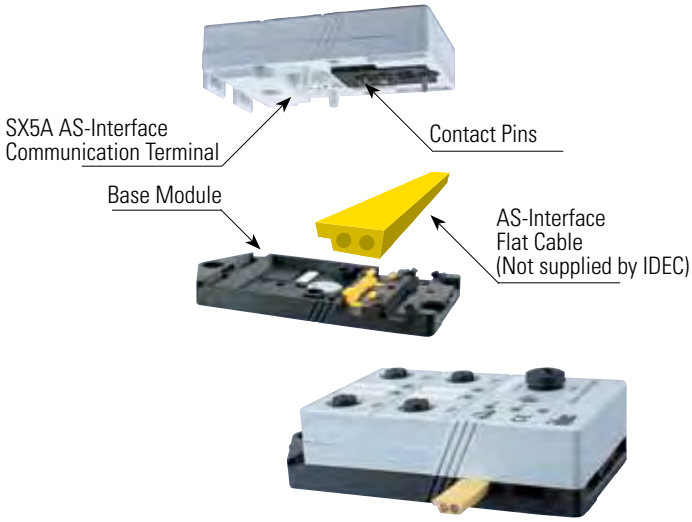
Quick & Secure Connection



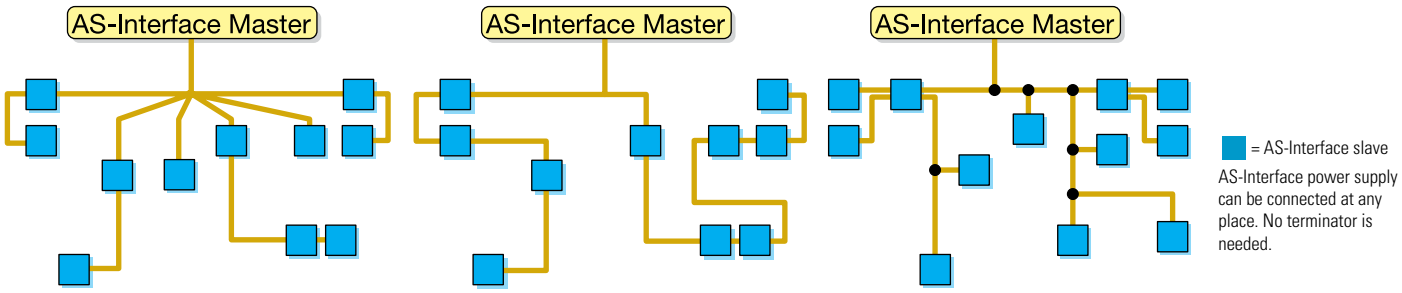
Spring clamp reduces wiring time

SwitchNet control units feature spring clamp terminals, eliminating the need for tightening screws.

Easy Wiring



Contact pins pierce through the cable's insulation and make secure contact with the copper conductor. After disconnecting the AS-Interface communication terminal, the elasticity of the sheath closes the pierced holes and maintains insulation.


AS-Interface Master
AS-Interface Master
AS-Interface Master
= AS-Interface slave
AS-Interface power supply can be connected at any place. No terminator is needed.

Tree Structure | Line Structure | Star Structure

Connectors

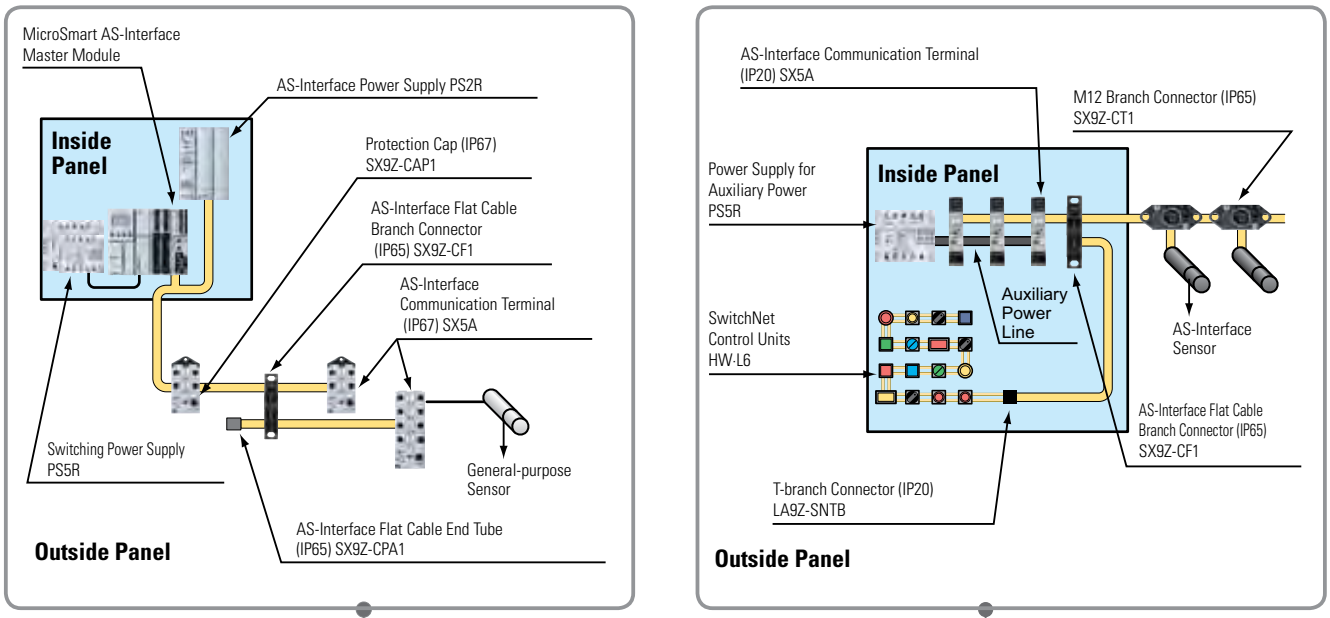
Three types of connectors are available for designing the panel layout.

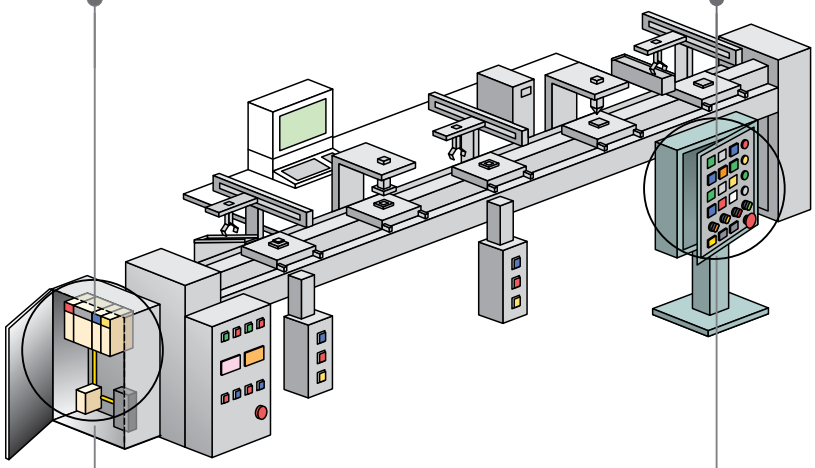
AS-Interface Flat Cable Branch Connector (IP65)

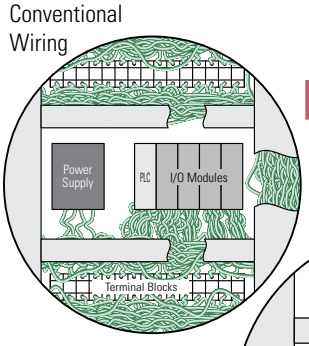
M12 Branch Connector (IP65)

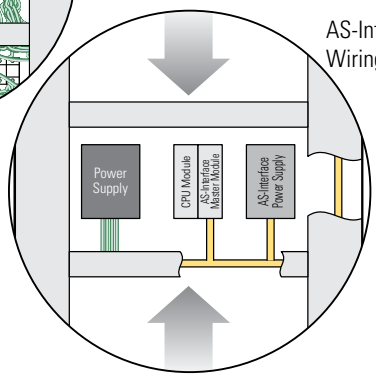
T-branch Connector (IP20)

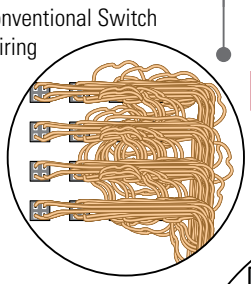
Space & Wire Savings

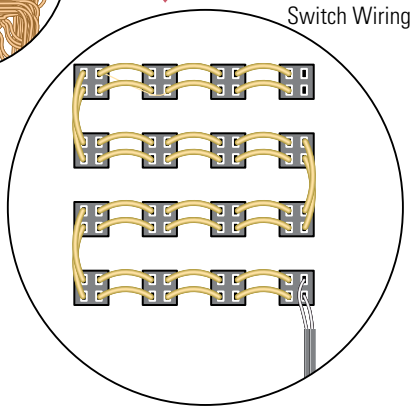

MicroSmart AS-Interface Master Module
AS-Interface Power Supply PS2R
Inside Panel
Protection Cap (IP67) SX9Z-CAP1
AS-Interface Flat Cable Branch Connector (IP65) SX9Z-CF1
AS-Interface Communication Terminal (IP67) SX5A
Switching Power Supply PS5R
General-purpose Sensor
AS-Interface Flat Cable End Tube (IP65) SX9Z-CPA1
Outside Panel
AS-Interface Communication Terminal (IP20) SX5A
M12 Branch Connector (IP65) SX9Z-CT1
Power Supply for Auxiliary Power PS5R
Inside Panel
Auxiliary Power Line
SwitchNet Control Units HW-L6
AS-Interface Sensor
AS-Interface Flat Cable Branch Connector (IP65) SX9Z-CF1
T-branch Connector (IP20) LA9Z-SNTB
Outside Panel









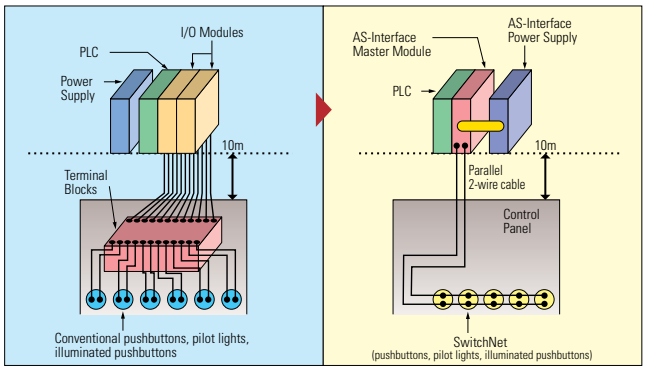


Cost Savings

Inside-Panel Wiring Example: Cost Savings Approximately 25%

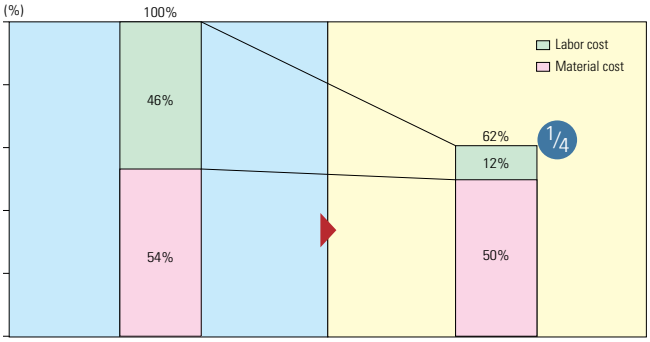
Wiring Comparison

Conventional Wiring | **AS-Interface & SwitchNet Wiring**



Cost Comparison

Conventional Wiring | **AS-Interface & SwitchNet Wiring**



Conventional Wiring

When using conventional wiring that involves a PLC and terminal blocks, the inside of the control panel is filled with wires for switches, pilot lights and other devices. Approximately half of the total panel cost is attributable to labor costs for wiring.

AS-Interface & SwitchNet Wiring

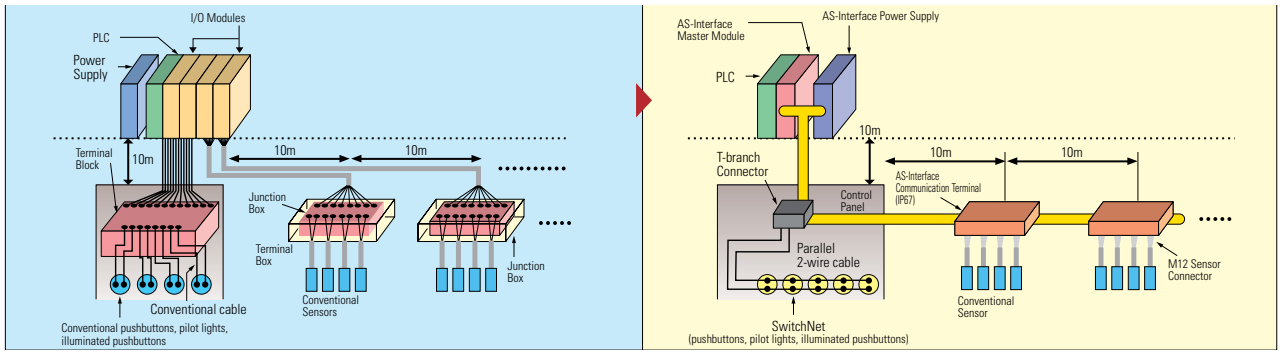
All SwitchNet units are connected to the AS-Interface master module using 2-wire cables. Wiring time is reduced to approximately 1/4 of the time needed for the conventional method and the total cost can be reduced up to 40%. In addition, maintenance is much easier.

1. Comparisons were made using IDEC products.
2. Cost comparison is based on control panel configuration using 60 buttons and lights.

Inside & Outside-Panel Wiring Example: Cost Savings Approximately 25%

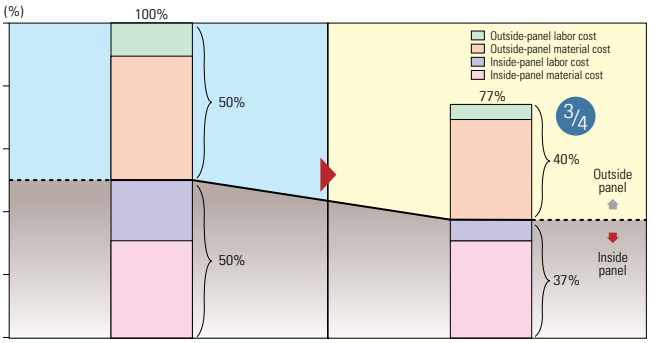
Wiring Comparison

Conventional Wiring | **AS-Interface & SwitchNet Wiring**



Cost Comparison

Conventional Wiring | **AS-Interface & SwitchNet Wiring**



Conventional Wiring

A large amount of space and cost is required by wiring to and inside junction boxes.

AS-Interface & SwitchNet Wiring

SwitchNet wiring reduces costs for inside-panel wiring resulting in a total cost reduction of approximately 25%.

1. Comparisons were made using IDEC products.
2. Cost comparison is based on control panel configuration using 60 buttons and lights.

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Relay Barriers 224
EB3C Relay Barriers 224
EB3N Safety Relay Barriers 229

Lamp Barriers 234
EB3L Lamp Barriers 234

General Information 248

Barriers

IDEC

www.IDEC.com/barriers

Selection Guide

Relay Barrier

Model	EB3C-**A	EB3C-**D	EB3N-**D
Appearance			
Page	224		229
Explosion Protection	UL/FM: Class I, II, III Div1 / Group A, B, C, D, E, F, and G Class I, Zone 0 / [AExia] II C CSA: Class I Div 1 / Group A, B, C, D NEMKO: [Exia] II C CQST: [Exia] II C GOST-R: [Exia] II C TIIS: Relay barrier [Exia] IIC Switch (EB9Z-A) [Exia] IICT6 Switch (EB9Z-A1) [Exia] IIBT6 NK: [Exia] II C KOSHA: [Exia] II C		UL: Class I, Zone 0, [AExia] II C Class I, II, III, Div. 1, Groups A, B, C, D, E, F and G IEC Ex: [Exia] II C PTB: II (1) G [Exia] II C II (1) D [ExiaD] CQST: [Exia] II C TIIS: [Exia] II C
Degree of Protection	IP20	IP20	IP20
Number of Channels	1, 2, 3, 5, 6, 8, 10, 16	1, 2, 3, 5, 6, 8, 10, 16	EB3N-□2ND: 2 safety circuits EB3N-□2R5D: 2 safety circuits, 5 auxiliary circuits
Power Voltage	100 to 240V AC (UL rating: 100- 120VAC)	24V DC	24V DC
Output	Relay Transistor (Sink/Source)	Relay Transistor (Sink/Source)	Relay
Connection	Screw Terminal	Screw Terminal, Connector	Screw Terminal
Mounting	35-mm-wide DIN rail Panel mounting	35-mm-wide DIN rail Panel mounting	35-mm-wide DIN rail / Panel mounting
Size (excluding projections)	42W×75H×77.5D (1 channel) 65W×75H×77.5D (2, 3 channels) 110.5W×75H×77.5D (5, 6, 8 channels (common)) 171.5W×75H×77.5D (8, 10 channels)	42W×75H×77.5D (1 channel) 65W×75H×77.5D (2, 3 channels) 110.5W×75H×77.5D (5, 6, 8 channels (common)) 171.5W×75H×77.5D (8, 10, 16 channels (common))	65.0W×75.0H×77.5D (EB3N-□2ND) 110.5W×75.0H×77.5D (EB3N-□2R5D)
Weight (approx.)	380g (EB3C-R10A)	390g (EB3C-R16CD)	220g (EB3N-□2ND) 300g (EB3N-□2R5D)

Lamp Barrier

Model	EB3L-**A	EB3L-**D
Appearance		
Page	234	
Explosion Protection	UL/FM: Class I, II, III Div1 / Group A, B, C, D, E, F, and G Class I, Zone 0 / [AExia] II C CSA: Class I Div 1 / Group A, B, C, D NEMKO: [Exia] II C CQST: [Exia] II C GOST-R: [Exia] II C TIIS: Lamp barrier [Exia] II C NK: [Exia] II C KOSHA: [Exia] II C	
Degree of Protection	IP20	IP20
Number of Channels	1, 2, 3, 5, 6, 8, 10	1, 2, 3, 5, 6, 8, 10, 16
Power Voltage	100 to 240V AC (UL rating: 100 ~ 120V AC)	24V DC
Input	Transistor input (sink) Transistor input (source)	Transistor input (sink) Transistor input (source)
Connection	Screw Terminal	Screw Terminal, Connector
Mounting	35-mm-wide DIN rail Panel mounting	35-mm-wide DIN rail Panel mounting
Size (excluding projections)	42W×75H×77.5D (1 channel) 65W×75H×77.5D (2, 3 channels) 110.5W×75H×77.5D (5, 6, 8 channels) 171.5W×75H×77.5D (8, 10 channels)	42W×75H×77.5D (1 channel) 65W×75H×77.5D (2, 3 channels) 110.5W×75H×77.5D (5, 6, 8 channels) 171.5W×75H×77.5D (8, 10, 16 channels (common))
Weight (approx.)	360g (EB3L-S10SA)	360g (EB3L-S16CSD)

Intrinsically Safe Explosion-Proof: EB3C Relay Barriers

Key features:

Explosion Protection	
Relay Barrier:	[Exia] II C

- IEC60079 compliant
- Dry-contact switches can be connected to the EB3C
- 8- and 16-circuit types are available in common wiring types, ideal for connection to PLCs (DC voltage only)
- Universal AC power voltage (100 to 240V AC) or 24V DC power (UL rating: 100 ~ 120V AC)
- No grounding required
- IDEC's original spring-up terminals minimizes wiring time
- Installation: 35-mm-wide DIN rail mounting or direct panel mounting
- Global usage
  USA: UL/FM
  Canada: CSA
  Europe: CE marking, ATEX
  China: CQST
  Russia: GOST-R
  Japan: TIIS
  Korea: KOSHA
- Ship class: NK (Japan), KR (Korea)

LISTED FM APPROVED NK KOREAN REGISTER

Dry Contact Switches

Dry-contact switches can be connected to the EB3C.

LB Series

CW Series

HW Series

Common Wiring for PLC Inputs

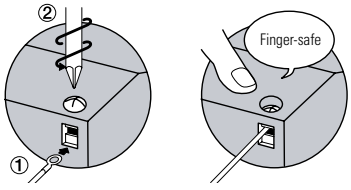
8- and 16-circuit types are available in common wiring types, ideal for connection to PLCs (DC voltage only).

Connector Type

MIL connector on the non-hazardous side

- Easy connection to PLCs
- Wiring is cut by 90% (compared with IDEC's 16-circuit EB3C)
- Various 20-pin MIL connectors can be connected

Spring-up Fingersafe Terminals Reduce Wiring Time



Part Numbers

Relay Barriers

Power Voltage	Number of Channels	Connection to Non-intrinsically Safe Circuit	Input Wiring Method	Output		Part Number
100 to 240V AC (UL rating: 100 ~ 120V AC)	1	Screw Terminal	Separate/Common Wiring Compatible	Relay		EB3C-R01A
	2					EB3C-R02A
	3					EB3C-R03A
	5					EB3C-R05A
	6					EB3C-R06A
	8					EB3C-R08A
	10					EB3C-R10A
	8		Common Wiring Only			EB3C-R08CA
	6		Separate/Common Wiring Compatible	Transistor (Sink/Source)		EB3C-T06A
	8					EB3C-T08A
	10					EB3C-T10A
	16		Common Wiring Only	Transistor (Sink)		EB3C-T16C
24V DC	8		Common Wiring Only	Relay		EB3C-R08CD
	10		Separate/Common Wiring Compatible			EB3C-R10D
	16		Common Wiring Only			EB3C-R16CD
	10		Separate/Common Wiring Compatible	Transistor (Sink/Source)		EB3C-T10D
	8		Common Wiring Only	Transistor	Sink	EB3C-T08CKD*
	16					EB3C-T16CKD*
	8				Source	EB3C-T08CSD
	16					EB3C-T16CSD
	16		Connector Wiring		Sink	EB3C-T16CKD-C*
					Source	EB3C-T16CSD-C

*Note: These models are NOT Listed by UL

Accessories

Item	Part Number	Description
DIN Rail	BAP1000	Steel (1m long, 7.5mm high)
	BNDN1000	Aluminum (1m long, 10.5mm high)
End Clip	BNL6	Medium DIN rail end clip

Specifications

Explosion-Protection and Electrical Specifications

Explosion Protection			See Certification Numbers table below	
Degree of Protection			IP20 (IEC60529)	
Installation Location	Relay Barrier		Safe indoor place (non-hazardous area)	
Non-intrinsically Safe Circuit Maximum Voltage (Um)			250V AC 50/60Hz, 250V DC 125V AC 50/60Hz, 125V DC (UL rating)	
Intrinsically Safe Circuits	Wiring Method		1-channel Separate Wiring	16-channel Common Wiring
	Rated Operating Voltage		12V DC ±10%	
	Rated Operating Current		10 mA DC ±20%	
	Maximum Output Voltage (Uo)		13.2V DC	
	Maximum Output Current (Io)		14.2 mA	227.2 mA
	Maximum Output Power (Po)		46.9 mW	750 mW
	Maximum External Inductance (Lo)*		175 (125) mH	0.68 (0.68) mH
	Maximum External Capacitance (Co)*		900 (740) nF	
	Allowable Wiring Resistance (Rw)		300Ω	600/(n+1)Ω (n = number of common channels)
	Maximum Channels per Common Line		–	16
Non-intrinsically Safe Circuits	Relay Output	Contact Configuration	1NO	
		Rated Insulation Voltage (Ui)	250V AC (UL rating: 125V AC), 125V DC	
		Thermal Current (Ith)	3A (common terminal: 8A)	
		Contact Allowable Power – Resistive Load	AC: 750 VA, DC: 72W	
		Contact Allowable Power – Inductive Load	AC: 750 VA (cos ø = 0.3 to 0.4) DC: 48W (L/R = 7 ms)	
		Rated Load – Resistive Load	250V AC 3A, 24V DC 3A	
		Rated Load – Inductive Load	250V AC 3A (cos ø = 0.3 to 0.4) 24V DC 2A (L/R = 7 ms)	
		Minimum Applicable Load	0.1V DC, 0.1 mA (reference value)	
		Contact Resistance	50 mΩ	
		ON Time	12 ms maximum (rated voltage)	
		OFF Time	10 ms maximum (rated voltage)	
		Mechanical Life	20,000,000 operations minimum (at 18,000 operations/hour, without load)	
		Electrical Life	100,000 operations minimum (at 1,800 operations/hour, rated load)	
		Short-circuit Protection	None	
	Transistor Output	Rated Voltage	24V DC	
		Maximum Voltage	30V DC	
		Maximum Current	100 mA (connector type: 15 mA)	
		Leakage Current	0.1 mA maximum	
		Voltage Drop	1V maximum	
		Clamping Voltage	33V (1W)	
		Inrush Current	0.5A maximum (1 sec)	
		ON Time	0.1 ms maximum (resistive load)	
		OFF Time	0.4 ms (typical) (resistive load)	
		Short-circuit Protection	None	

Values in ( ) are those approved by TIIS (Technology Institution of Industrial Safety, Japan).
Note: Um = 125V AC for UL ratings

General Specifications

		AC	DC
Rated Voltage		100 to 240V AC (UL rating: 100 ~ 120V AC)	24V DC
Allowable Voltage Range		85 to 264V AC (UL rating: 85 ~ 125V AC)	21.6 to 26.4V DC
Rated Frequency		50/60 Hz (allowable range: 47 to 63 Hz)	—
Inrush Current		10A (100V AC) 20A (200V AC)	10A
Dielectric Strength (1 minute, 1 mA)		Between intrinsically safe circuit and non-intrinsically safe circuit: 1500V AC	
		Between AC power and output terminal: 1500V AC	
		Between DC power and transistor output terminal: 1000V AC	
Operating Temperature		–20 to +60°C (no freezing)	
Storage Temperature		–20 to +60°C (no freezing)	
Operating Humidity		45 to 85% RH (no condensation)	
Atmosphere		800 to 1100 hPa	
Pollution Degree		2 (IEC60664)	
Insulation Resistance		10 MΩ minimum (500V DC megger, between the same poles as the dielectric strength)	
Vibration Resistance	Damage Limits	Panel mounting: 10 to 55 Hz, amplitude 0.75 mm	
		DIN rail mounting: 10 to 55 Hz, amplitude 0.35 mm	
	Operation Extremes (relay output only)	Panel mounting: 10 to 55 Hz, amplitude 0.5 mm	
		DIN rail mounting: 10 to 55 Hz, amplitude 0.35 mm	
Shock Resistance	Damage Limits	Panel mounting: 500 m/s² (3 times each on X, Y, Z)	
		DIN rail mounting: 300 m/s² (3 times each on X, Y, Z)	
Terminal Style		M3 screw terminal	
Mounting		35-mm-wide DIN rail or panel mounting (M4 screw)	
Power Consumption (approx.)		9.6 VA (EB3C-R10A at 200V AC) 4.8 W (EB3C-R16CD at 24V DC)	
Weight (approx.)		390g (EB3C-R16CD)	

Certification Numbers

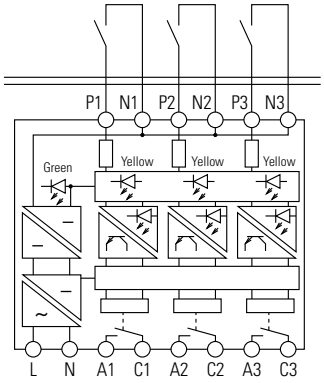
Certification Organization	Explosion Protection	Certification Number
UL/FM	Class I, II, III Div. 1 Groups A, B, C, D, E, F and G	3015417 UL file: E234997
	Class I, Zone 0 AEx [ia] IIC	
CSA	Class I Div. 1 Groups A, B, C, D	166730
NEMKO	[Exia] II C	Nemko 02ATEX279
TIIS Japan	Relay barrier: [Exia] II C	TC15753
Class NK	[Exia] II C	02T606
GOST-R	[Exia] II C	РОСС JP.ГБ05.В02067
KOSHA	[Exia] II C	11-AV4BO-0457
CQST	[Exia] II C	CNEx10.2445

Class NK is Japan Shipping agency approval, Class KR is Korean shipping agency approval.

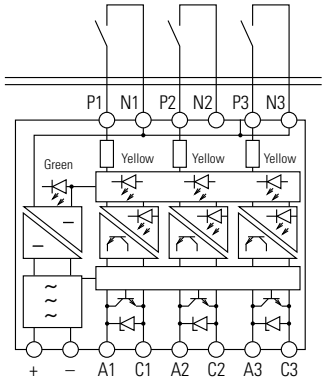
Circuit Diagrams

Internal Circuit Block Diagrams

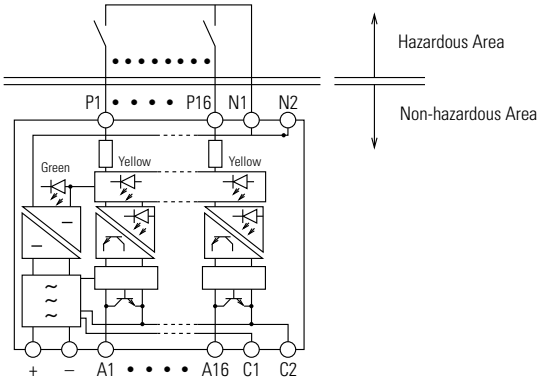
AC Power, Relay Output Type



DC Power, Transistor Output Type



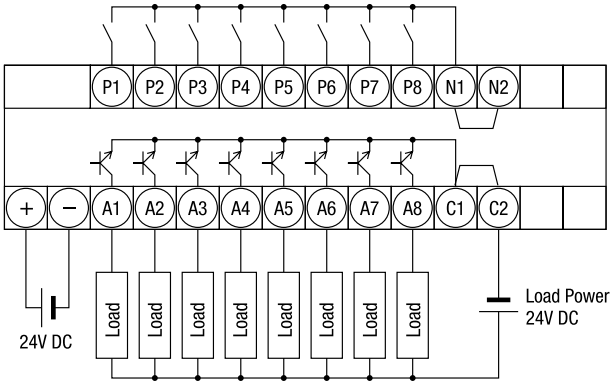
Connector Wiring, Sink Output Type



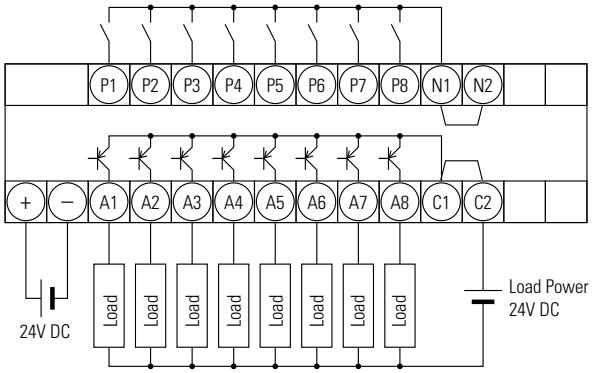
Wiring Examples

External Wiring Examples

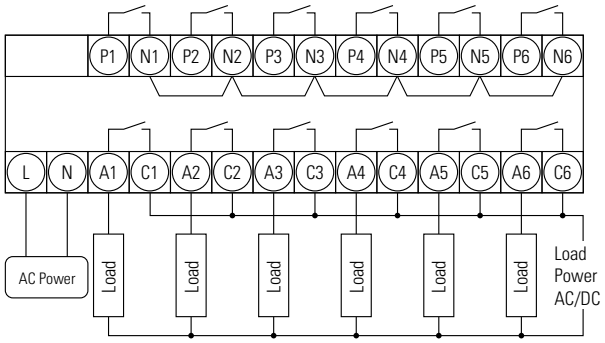
Transistor Sink Output Type (Ex.: EB3C-T08CKD)



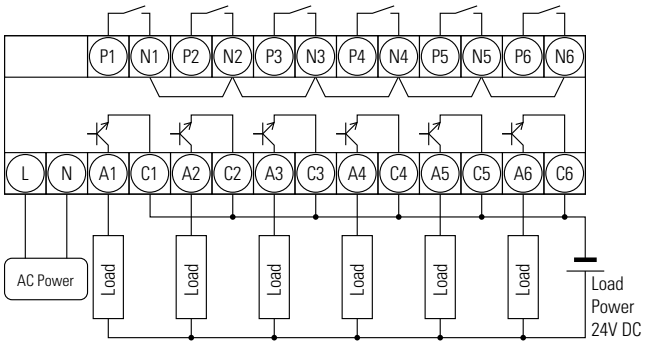
Transistor Source Output Type (Ex.: EB3C-T08CSD)



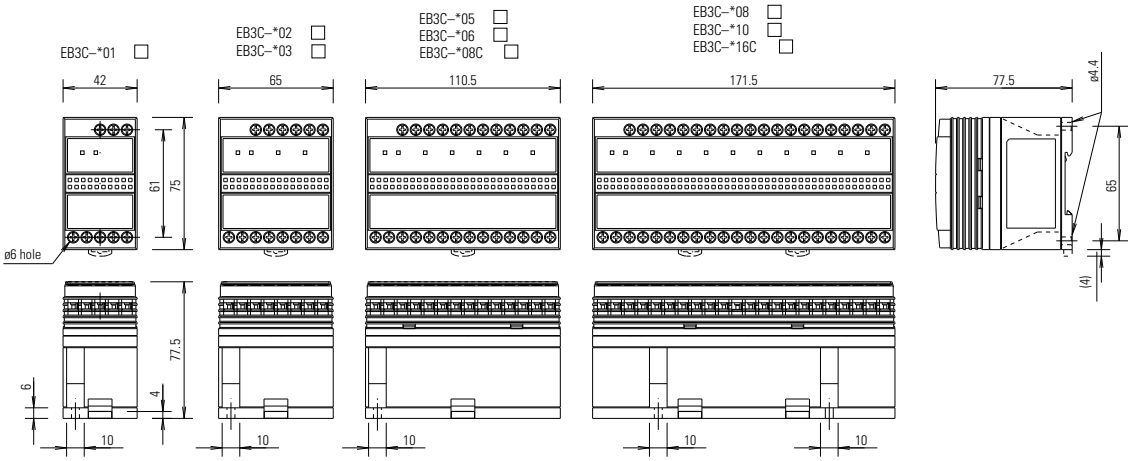
Relay Output Type (Ex.: EB3C-R06A)



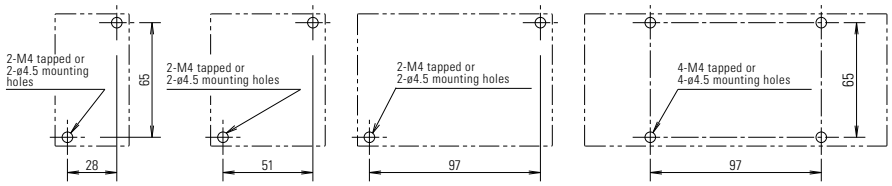
Transistor Output Type (Ex.: EB3C-T06A)



Dimensions (mm)

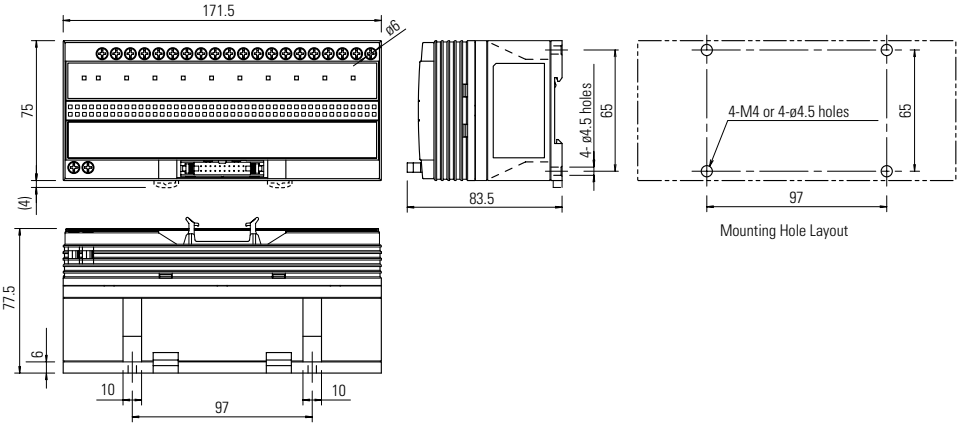


Mounting Hole Layout (Screw Mounting)

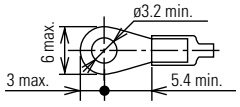


Connector

EB3C–T16C☐-C

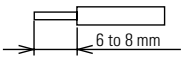


Applicable Crimping Terminal



Stripping the Wire End

Solid Wire



Stranded Wire (Ferrule)

EB3N Safety Relay Barriers

Build a safety system in an explosive atmosphere.
Key features:

Explosion Protection	Safety Relay Barrier	[Exia] II C	Safety Performance	Performance level e	Category 4

- Ensures explosion protection safety and machine safety in an explosive atmosphere
- Machine safety system can be built in compliance with ISO13849-1 Category 4, Performance level e
- Safety input devices applicable in any explosive gas and hazardous areas are available.
- Available with auxiliary inputs (5 points) used to monitor the operating status of safety input devices
- A wide variety of Japan TIIS-rated emergency stop switches and interlock switches are available
- Global usage
- Explosion protection: Japan (TIIS), USA (UL), Europe (ATEX), China (CQST), IEC Ex
- Machine safety: TÜV Rheinland
- No grounding required

Safety Relay Barriers

Safety Input Points	Safety Output Points	Auxiliary Input Points [1]	Auxiliary Output Points (Relay Output)	Reset (Start) [2 3]	Part Number
2	2NO	Without	Without	Auto reset (Auto start)	EB3N-A2ND
				Manual reset (Manual start)	EB3N-M2ND
2	2NO	5 (1 common)	5NO (1 common)	Auto reset (Auto start)	EB3N-A2R5D
				Manual reset (Manual start)	EB3N-M2R5D

1. A maximum of five monitor contacts from safety input devices can be connected to the auxiliary input terminals. In addition, non-safety input devices can also be connected to the auxiliary input terminals.
2. On auto reset (auto start) models, when the safety condition is met (two safety inputs are both on), safety outputs are turned on automatically.
   Connect the reset (start) input terminals Y1 and Y2 together except for the following cases:
   When connecting a contactor or force guided relay to the safety output of the EB3N, connect the NC contacts of the contactor or force guided relay to the reset (start) input terminals Y1 and Y2 of the EB3N for use as a backcheck input signal.
3. On manual reset (manual start) models, while the safety condition is met (two safety inputs are both on), safety outputs are turned on at the falling edge of the reset switch (start switch) signal (OFF → ON → OFF) (start off check).
   Manual reset (manual start) models have a monitoring function of reset switch contacts (detection of welded contacts). Use NO contacts of a momentary switch for the reset (start) input.
   When connecting a contactor or force guided relay to the safety output of the EB3N, connect the NC contacts of the contactor or force guided relay to the reset (start) input terminals Y1 and Y2 of the EB3N for use as a backcheck input signal.

Selection Guide

1. Selecting the reset (start) function

Auto reset (auto start): Select this model when connecting safety control devices, such as safety relay modules or safety controllers, to the EB3N safety outputs to set up a safety system, using the reset (start) function of the safety control device.

Select this model when connecting contactors or force guided relays to the EB3N safety outputs to set up a safety system, and a risk assessment on the entire system has not found any safety problem in using auto reset (auto start).

Manual reset (manual start): Select this model when connecting contactors or force guided relays to the EB3N safety outputs to set up a safety system, and a risk assessment on the entire system has found that manual reset (manual start) is necessary.

2. Selecting the auxiliary outputs

Without auxiliary outputs: Select this model when the operating status of safety input devices are not monitored.

With auxiliary outputs: Select this model when the operating status of safety input devices are monitored or when non-safety input devices are also connected.

Specifications

General

Rated Power Voltage			24V DC
Power Voltage Range			20.4 to 26.4V DC
Operating Temperature			–20 to +60°C (no freezing) UL: –20 to +40°C (no freezing)
Operating Humidity			45 to 85% RH (no condensation)
Power Consumption	Without auxiliary output		5.5W maximum
	With auxiliary output		7.0W maximum
Safety Output	Contacts	13-14, 23-24	2NO
	Rated Load	Resistive	30V DC, 1A
		Inductive	DC-13, 24V, 1A
	Response (rated voltage)	Turn on	100 ms maximum
		Turn off	20 ms maximum
Auxiliary Output	Contacts	A* - C1	5NO/1 common
	Rated Load	Resistive	24V DC, 3A, common terminal 5A max.
	Response (rated voltage)	Turn on	15 ms maximum
		Turn off	10 ms maximum
Mounting			DIN rail or panel mounting

*: Channel Numbers: 1 to 5

Explosion-protection

Explosion Protection		[Exia] II C
Non-intrinsically Safe Circuit Maximum Voltage (Um)		250V (UL: 125V)
Intrinsically Safe Circuit Maximum Voltage (Uo)		13.2V
Intrinsically Safe Circuit Maximum Current (Io)		227.2 mA
Intrinsically Safe Circuit Maximum Power (Po)		750 mW
Intrinsically Safe Circuit Allowable Capacitance (Co)		0.49 µF (TIIS: 0.28 µF)
Intrinsically Safe Circuit Allowable Inductance (Lo)		0.60 mH (TIIS: 0.56 mH)
Intrinsically Safe Circuit Wiring Resistance (Rw)	Safety circuit	(Note 1)
	Auxiliary circuit	(Note 2)

1. 10Ω maximum (500m maximum using a 1.25 mm2 cable)
2. 600/(N+1)Ω maximum, where N = the number of common channels

Safety

Category	4
Performance Level (PL)	e
Mean Time to Dangerous Failure (MTTFd)	100 years
Diagnostic Range	99% minimum

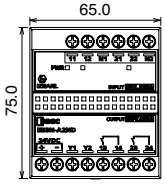
Calculation conditions for MTTFd
t_{cycle}: Mean operation cycle = 1 hour
h_{op}: Mean operation hours per day = 24 hours
d_{op}: Mean operation days per year = 365 days
Note: When t_{cycle} is shorter than 1 hour, MTTFd will decrease

Certification Number

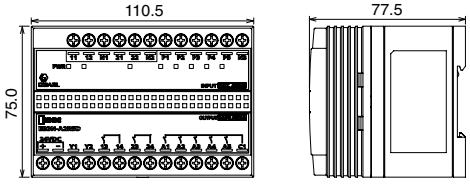
Certification Organization	Explosion Protection	Certification Number
TIIS	Safety Relay Barriers [Exia] II C Switch (EB9Z-A) Exia II CT6 Switch (EB9Z-A1) Exia II BT6	TC18753 TC15758 T15961
PTB	[Exia] II C, [Exia D]	IEC Ex PTB 10.0015
	II (1) G [Exia] II C II (1) D [Exia D]	PTB 09 ATEX 2046
CQST	[Exia] II C	CNEx 11.0038
UL	Class I, Zone 0, [AExia] II C Class I, II, III, Div. 1, Groups A, B, C, D, E, F and G	E234997

Dimensions (mm)

EB3N-A2ND
EB3N-M2ND



EB3N-A2R5D
EB3N-M2R5D



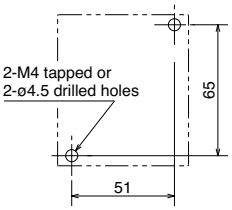
Terminal Functions

24V DC	Power
Y1-Y2	Reset input (Start input)
11-12	Safety input 1
21-22	Safety input 2
N1, N2	Signal ground
P*-N3	Auxiliary input
13-14	Safety output 1
23-24	Safety output 2
A*-C1	Auxiliary output

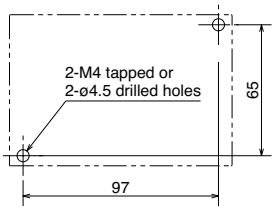
*: 1 to 5

Mounting Hole Layout

EB3N-A2ND
EB3N-M2ND

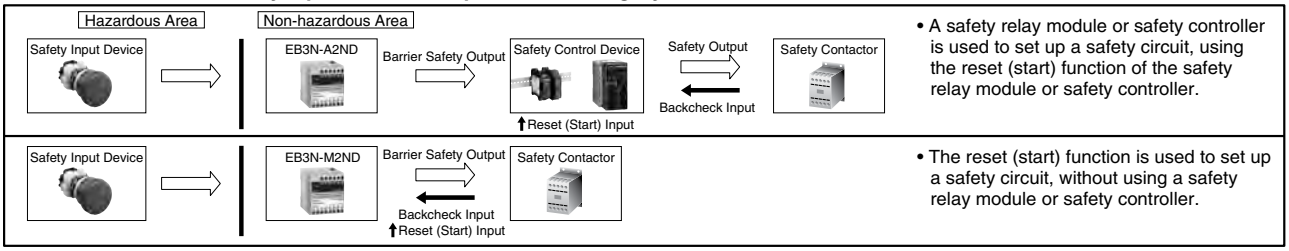


EB3N-A2R5D
EB3N-M2R5D



EB3N System Configuration Examples

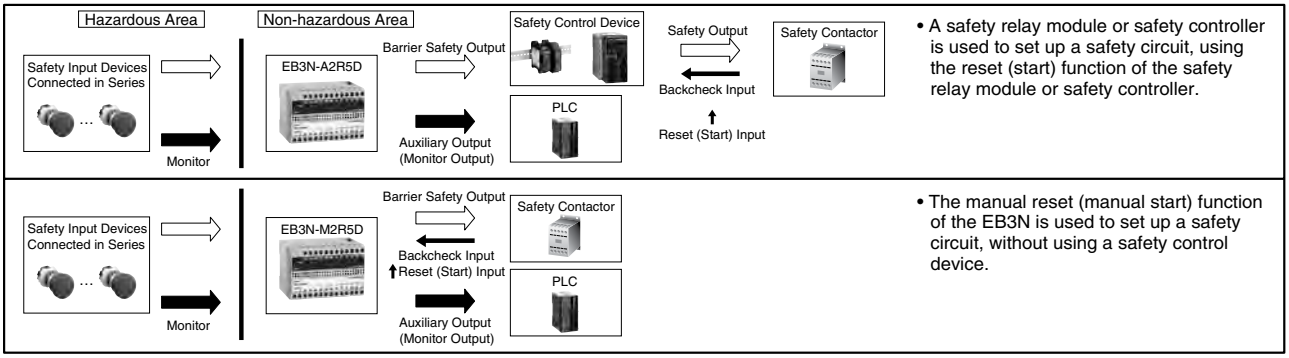
1:1 connection with a safety input device, compliant with Category 4



- A safety relay module or safety controller is used to set up a safety circuit, using the reset (start) function of the safety relay module or safety controller.
- The reset (start) function is used to set up a safety circuit, without using a safety relay module or safety controller.

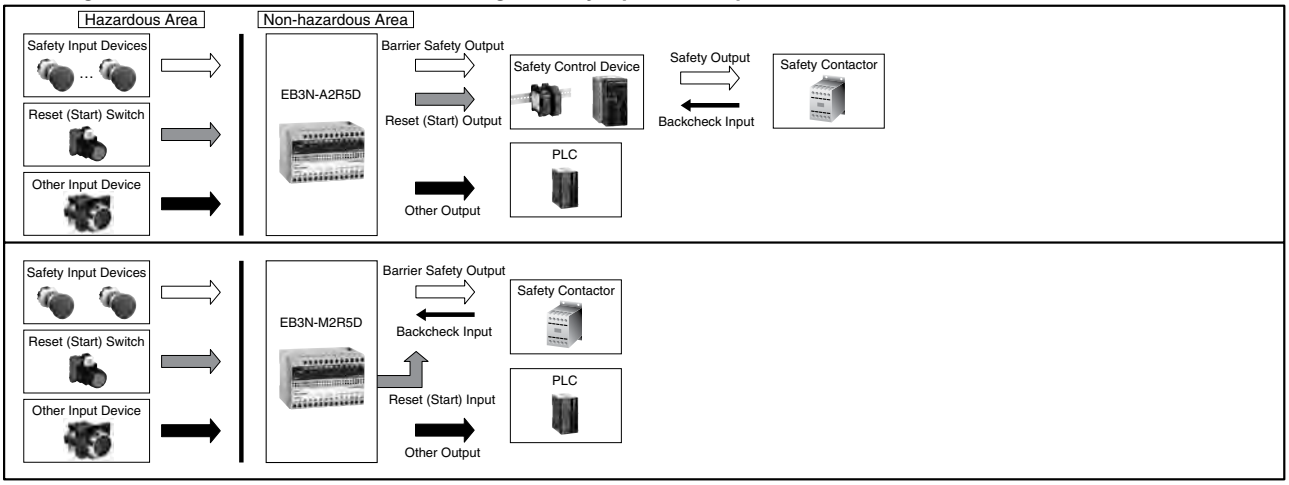
Connection with multiple safety input devices, capable of monitoring up to 5 contact operations, compliant with Category 3

For monitoring operating statuses of safety input devices located in a non-hazardous area



- A safety relay module or safety controller is used to set up a safety circuit, using the reset (start) function of the safety relay module or safety controller.
- The manual reset (manual start) function of the EB3N is used to set up a safety circuit, without using a safety control device.

Installing a reset switch in a hazardous area, using auxiliary input and output



Safety Input Devices Connectable to Safety Input Terminals (Examples)

Emergency stop switch: (Non-illuminated) XW1E, XN4E
Safety switch: HS6B-02B05, HS1B-02R

Instructions

Notes for Operation

1. Do not disassemble, repair, or modify the EB3N safety relay barrier, otherwise the safety characteristics may be impaired.
2. Use the EB3N within its specification values.
3. The EB3N can be mounted in any direction.
4. Mount the EB3N on a 35-mm-wide DIN rail or directly on a panel surface using screws. When mounting on a DIN rail, push in the clamp and use end clips to secure the EB3N. When mounting on a panel surface, tighten the screws firmly.
5. Excessive noise may cause malfunction or damage to the EB3N. When the internal voltage limiting circuit (thyristor) has shut down the power due to noise, remove the cause of the noise before powering up again.
6. The internal power circuit contains an electronic fuse to suppress overcurrents. When the electronic fuse has tripped, shut down the power, remove the cause of the overcurrent before powering up again.
7. Use crimping terminals with insulation sheath for wiring. Tighten the terminal screws, including unused terminal screws, to a recommended tightening torque of 0.6 to N·m using a screwdriver of ø5.5 mm in diameter.
8. Before inspecting or replacing the EB3N, turn off the power.

Notes for Machine Safety

1. Operate the safety input device to check the EB3N functionality everyday.
2. For safety input devices, such as safety switches or emergency stop switches, connected to the EB3N, use safety standard-compliant devices with direct opening action and 2NC contacts.
3. Do not use the auxiliary input as a safety input.
4. For safety control devices connected with the EB3N, use machine safety standard-compliant devices with a disparity detection function.
5. Use safety inputs and safety outputs in a circuit configuration compliant with safety requirements.
6. To calculate the safety distance, take into consideration the response time of all devices comprising the system, such as the EB3N and safety devices connected to the EB3N.
7. Separate the input and output wiring from power lines and motor lines.
8. When using multiple EB3N safety relay barriers, do not connect one switch to more than one EB3N. Use separate switches for each EB3N.
9. To ensure EMC, use shielded cables for safety inputs and auxiliary inputs. Connect the shield to the FG of the control panel on which the EB3N is mounted.
10. For protection against overcurrents, connect an IEC60127-2-compliant 2A fast-blow fuse (5 × 20 mm).
11. Evaluate the ISO 13849-1 category and performance level in consideration of the entire system.

Notes for Explosion Protection Safety

1. Install the EB3N in an enclosure capable of protecting against mechanical shocks at a hazardous location in accordance with intrinsic safety ratings and parameters.
2. Install and wire the EB3N so that the EB3N is not subject to electromagnetic and electrostatic induction and does not contact with other circuits.
   For example, keep a minimum spacing of 50 mm between intrinsically safe and non-intrinsically safe circuits, or provide a metallic separating board between the intrinsically safe circuit and non-intrinsically safe circuit. When providing a metallic separating board, make sure that the board fits closely to the enclosure (top, bottom, and both sides). Allowable clearance between the board and the enclosure is 1.5 mm at the maximum.
   When a motor circuit or high-voltage circuit is installed nearby, keep a wider spacing than 50 mm between intrinsically safe and non-intrinsically safe circuits.
3. Keep a minimum spacing of 3 mm between the terminal or relay terminal block of the intrinsically safe circuit and the grounded metal parts of the metal enclosure.
4. Connect the terminals so that IP20 is ensured.
5. To prevent disengaged wires from contacting with other intrinsically safe circuits, bind together the end of wires.
6. Make sure that the voltage of the power supply for the devices connected to the non-intrinsically safe circuit or the internal voltage of such devices does not exceed 250V AC/DC 50/60 Hz (UL rating: 125V AC 50/60 Hz) or 250V DC (UL rating: 200V DC) under any normal and abnormal conditions.
7. Make sure that the wiring of intrinsically safe circuits does not contact with other circuits or is not subject to electromagnetic and electrostatic inductions, otherwise explosion protection is not ensured.
8. When identifying intrinsically safe circuits by color, use light blue terminal blocks and cables.
9. When wiring the intrinsically safe circuit, determine the distance to satisfy the wiring parameters shown below.
   a) Wiring capacitance Cw ≤ Co – Ci
      Co: Intrinsically safe circuit allowable capacitance
      Ci: Internal capacitance of switches
   b) Wiring inductance Lw ≤ Lo – Li
      Lo: Intrinsically safe circuit allowable inductance
      Li: Internal inductance of switches
   c) Wiring resistance ≤ Rw
      Rw: Allowable wiring resistance

Switches in the Hazardous Area

1. A switch contains the switch contact, enclosure, and internal wiring. A switch contact refers to an ordinary switching device which consists of contacts only.
2. When the switch has internal wiring or lead wire, make sure that the values of internal capacitance (Ci) and inductance (Li) are within the certified values.
3. Enclose the bare live part of the switch contact in an enclosure of IP20 or higher protection.
4. Depending on the explosion-protection specifications of TIIS, the exposed area of plastic switch operator, when installed in Japan, is limited as follows:

Certification	Explosion Protection	Exposed Area
TC15758	Exia II CT6	20 cm^2 maximum
TC15961	Exia II BT6	100 cm^2 maximum

EB3L Lamp Barriers

126 types of pilot lights and buzzers can be connected. Illuminated pushbuttons and illuminated selector switches can be connected by combining with the EB3C relay barrier. No grounding required.

Key features:

Explosion protection	
Lamp Barrier	[Exia] II C
Pilot Light (separate wiring)	Exia II CT6
Pilot Light (common wiring)	Exia II CT4
Illuminated Pushbutton	Exia II CT4
Illuminated Selector Switch	Exia II CT4
Buzzer (separate wiring)	Exia II CT6

- IEC60079 compliant
- Compact and lightweight (46% footprint and 36% weight compared to IDEC's 10-circuit IBPL)
- 8- and 16-channel types are available in common wiring types, ideal for connection to PLCs. 16-circuit types are also available with a connector.
- Universal AC power voltage (100 to 240V AC or 24V DC power [UL rating: 100 ~ 120V AC])
- No grounding required
- IDEC's original spring-up terminal minimizes wiring time.
- Installation, 35-mm-wide DIN rail mounting or direct screw mounting
- ø6, ø8, ø10, ø22 and ø30 pilot lights available
- Illuminated pushbuttons and illuminated selector switches can be connected by combining with the EB3C relay barrier.
  Illumination colors: Amber, blue, green, red, white, and yellow
  (pushlock turn reset type: red only)
- Continuous and intermittent sound types are available for buzzers (ø30).
- Global usage
  USA: UL/FM
  Canada: CSA
  Europe: CE marking, ATEX
  China: CQST
  Russia: GOST-R
  Japan: TIIS
  Korea: KOSHA
- Ship class: NK (Japan), KR (Korea)

Illuminated Pushbutton/Selector Switches

Illuminated pushbutton/selector switches can be used with the combination of EB3C and EB3L.

EB3L Lamp Barrier

EB3C Relay Barrier

Common Wiring for PLC Inputs

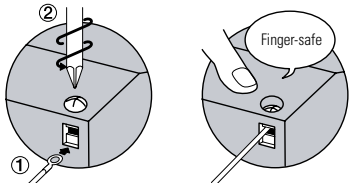
8- and 16-circuit types are available in common wiring types, ideal for connection to PLCs (DC voltage only).

Connector Type

MIL connecotr on the non-hazardous side

- Easy connection to PLCs
- Wiring is cut by 90% (compared with IDEC's 16-circuit EB3C)
- Various 20-pin MIL connectors can be connected.

Spring-up Fingersafe Terminals Reduce Wiring Time



Specifications

Explosion-Protection and Electrical

Explosion Protection		Intrinsic safety type (IEC compliant) [Exia] II C	
Degree of Protection		IP20 (IEC60529)	
Installation Location	Lamp Barrier	Safe indoor place (non-hazardous area)	
	Pilot Light, Illuminated Switch, Buzzer (TIIS approval only)	For zone 0, 1, 2 hazardous areas	
Non-intrinsically Safe Circuit Maximum Voltage (Um)		250V AC 50/60Hz, 250V DC UL value: 125V AC	
Operation		Input ON, Output ON (1:1)	
Intrinsically Safe Circuits (Output)	Wiring Method	1-channel Separate Wiring	16-channel Common Wiring
	Rated Operating Voltage	12V DC	
	Rated Operating Current	10 mA DC ±10%	
	Maximum Output Voltage (Uo)	13.2V DC ±10%	
	Maximum Output Current (Io)	14.2 mA	227.2 mA
	Maximum Output Power (Po)	46.9 mW	750 mW
	Maximum External Capacitance (Co) [1]	900 (740) nF	
	Maximum External Inductance (Lo) [1]	175 (125) mH	0.68 (0.68) mH
	Allowable Wiring Resistance (Rw)	200/(N+1)Ω (N = number of common channels)	
	Maximum Channels per Common Line	16	
	Voltage and Current when Connecting Control Units	Pilot light: 3.5V, 8.5 mA Miniature pilot light: 2V, 10 mA Illuminated switch: 3.5V, 8.5 mA Buzzer: 6.5V, 5.5 mA	
Non-intrinsically Safe Circuits (Signal Input)		Rated voltage: 24V DC Rated current: 5 mA (connector type: 4 mA)	

1. Values in ( ) are those approved by TIIS (Technology Institution of Industrial Safety, Japan).

General

Power Voltage Type	AC Power	DC Power
Rated Power Voltage	100 to 240V AC (UL rating: 100 ~ 120V AC)	24V DC
Allowable Voltage Range	85 to 264V AC (UL rating: 85 ~ 125V AC)	21.6 to 26.4V DC
Rated Frequency	50/60 Hz (allowable range: 47 to 63 Hz)	—
Inrush Current	10A (100V AC) 20A (200V AC)	10A
Dielectric Strength (1 minute, 1 mA)	Between intrinsically safe circuit and non-intrinsically safe circuit: 1500V AC	
	Between AC power and signal input: 1500V AC	
Operating Temperature	–20 to +60°C (no freezing)	
Storage Temperature	–20 to +60°C (no freezing)	
Operating Humidity	45 to 85% RH (no condensation)	
Atmosphere	800 to 1100 hPa	
Pollution Degree	2 (IEC60664)	
Insulation Resistance	10 MΩ minimum (500V DC megger, between the same poles as the dielectric strength)	
Vibration Resistance (damage limits)	Panel mounting: 10 to 55 Hz, amplitude 0.75 mm (2 hours each on X, Y, Z)	
	DIN rail mounting: 10 to 55 Hz, amplitude 0.35 mm (2 hours each on X, Y, Z)	
Shock Resistance (damage limits)	Panel mounting: 500 m/s^2 (3 times each on X, Y, Z)	
	DIN rail mounting: 300 m/s^2 (3 times each on X, Y, Z)	
Terminal Style	M3 screw terminal	
Mounting	35-mm-wide DIN rail or panel mounting (M4 screw)	
Power Consumption (approx.)	8.8 VA (EB3L-S10SA at 200V AC) 5.2 W (EB3L-S16CSD at 24V DC)	

General Specifications of Pilot Light, Illuminated Pushbutton, Illuminated Selector Switch, and Buzzer

Operating Temperature		–20 to +60°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Dielectric Strength (1 mA, 1 minute)		EB3P: 1000V AC IPL1: 500V AC (between intrinsically safe circuit and dead parts)
Insulation Resistance		10 MΩ minimum (500V DC megger, between the same poles as the dielectric strength)
Pilot Light and Miniature Pilot Light	Degree of Protection	IP65 (IEC60529) (except for terminals) EB3P-LU/IPL1: IP40
	Lens/Illumination Color	Pilot light: Amber, blue, green, red, white, yellow Miniature pilot light: Amber, green, red, white, yellow
	Intrinsic Safety Ratings and Parameters	1-channel Separate Wiring Maximum input voltage (Ui): 13.2V Maximum input current (Ii): 14.2 mA Maximum input power (Pi): 46.9 mW Internal capacitance (Ci): ≤ 2 nF Internal inductance (Li): ≤ 5 µH 16-channel Common Wiring Maximum input voltage (Ui): 13.2V Maximum input current (Ii): 227.2 mA Maximum input power (Pi): 750 mW Internal capacitance (Ci): ≤ 32 nF Internal inductance (Li): ≤ 80 µH
Illuminated Switch	Degree of Protection	IP65 (IEC60529) (except for terminals) EB3P-LSAW**: IP54
	Illumination Color	Amber, blue, green, red, white, yellow
	Contact Voltage/Current	12V DC ±10%, 10 mA ±20% (when connecting to the EB3C)
	Intrinsic Safety Ratings and Parameters	16-channel Common Wiring Maximum input voltage (Ui): 13.2V Maximum input current (Ii): 227.2 mA Maximum input power (Pi): 750 mW Internal capacitance (Ci): ≤ 32 nF Internal inductance (Li): ≤ 80 µH
Buzzer	Degree of Protection	IP20 (IEC60529) (except for terminals)
	Sound Volume	75 dB minimum (at 1 m)
	Sound Source	Piezoelectric oscillator (continuous or intermittent)
	Intrinsic Safety Ratings and Parameters	1-channel Separate Wiring Maximum input voltage (Ui): 13.2V Maximum input current (Ii): 14.2 mA Maximum input power (Pi): 46.9 mW Internal capacitance (Ci): ≤ 260 nF Internal inductance (Li): ≤ 100 mH
	Weight	100g

Note: Connect buzzers in separate wiring. Buzzers cannot be used in common wiring.

Certification Number

Certification Organization	Explosion Protection	Certification No.
FM	Class I, II, III Div. 1 Group A, B, C, D, E, F, G	3015417
	Class I, Zone 0 AEx [ia] II C	
CSA	Class I Div. 1 Group A, B, C, D	LR 21451
NEMKO	Lamp barrier: [Exia] II C Buzzer: Exia II CT6	Nemko 02ATEX279 Nemko 03ATEX1628X
CQST	Lamp barrier: [Exia] II C Buzzer: Exia II CT6	CNEX 10.2445
GOST-R	[Exia] II C	POCC JP.ГБ05.B03253
TIIS	Lamp barrier: [Exia] II C	TC16355
	Pilot light/miniature pilot light: (separate wiring): Exia II CT6	TC16361
	Pilot light/miniature pilot light: (common wiring): Exia II CT4	TC16360
	Illuminated switch: Exia II CT4	TC16362
	Buzzer: Exia II CT6	TC16363
NK	Lamp barrier: [Exia] II C Buzzer: Exia II CT6	Type Test No. 02T606 Type Test No. 04T605
KOSHA	Lamp barrier: [Exia] II C Buzzer: Exia II CT6	KOB17821-EL001 KOB17821-EL002

Note: Illuminated switches, pilot lights, and miniature pilot lights are certified by TIIS and NK only. Other certification organizations, such as UL, regard these units as simple apparatus, and require no certification.

Part Numbers

Lamp Barriers

Power Voltage	Connection to Non-intrinsically Safe Circuit	Input	Input Wiring Method	Number of Channels	Part Number	Weight (g)
100 to 240V AC (UL rating: 100 ~ 120V AC)	Screw Terminal	Source	Separate/Common Wiring Compatible	1	EB3L-S01SA	150
				2	EB3L-S02SA	180
				3	EB3L-S03SA	190
				5	EB3L-S05SA	250
				6	EB3L-S06SA	260
				8	EB3L-S08SA	330
				10	EB3L-S10SA	360
			Common Wiring Only	8	EB3L-S08CSA	260
		Sink	Separate/Common Wiring Compatible	1	EB3L-S01KA	150
				2	EB3L-S02KA	180
				3	EB3L-S03KA	190
				5	EB3L-S05KA	250
				6	EB3L-S06KA	260
				8	EB3L-S08KA	330
				10	EB3L-S10KA	360
24V DC	Screw Terminal	Source	Separate/Common Wiring Compatible	1	EB3L-S01SD	130
				2	EB3L-S02SD	160
				3	EB3L-S03SD	170
				5	EB3L-S05SD	240
				6	EB3L-S06SD	250
				8	EB3L-S08SD	310
				10	EB3L-S10SD	250
			Common Wiring Only	8	EB3L-S08CSD	340
				16	EB3L-S16CSD	350
		Sink	Separate/Common Wiring Compatible	1	EB3L-S01KD	130
				2	EB3L-S02KD	160
				3	EB3L-S03KD	170
				5	EB3L-S05KD	240
				6	EB3L-S06KD	250
				8	EB3L-S08KD	310
				10	EB3L-S10KD	340
			Common Wiring Only	8	EB3L-S08CKD*	250
				16	EB3L-S16CKD*	350
	Connector	Source	Common Wiring Only	16	EB3L-S16CSD-C	350
		Sink		16	EB3L-S16CKD-C*	350

*Note: These models are NOT Listed by UL

Accessories

Name	Part Number	Description
DIN Rail	BNDN1000	Aluminum (1m long, 10.5mm high)
	BAP1000	Steel (1m long, 7.5mm high)
End Clip	BNL6	Medium DIN rail end clip

Pilot Lights, Illuminated Pushbuttons, Illuminated Selector Switches, and Buzzers

Unit	Size	Series [1]	Shape	Operation Mode	Contact	Ordering Number	Lens Color/ Illumination Color Code*	Operation
Pilot Light	ø30	N	Dome	—	—	EB3P-LAN1-*	A: Amber G: Green R: Red S: Blue W: White Y: Yellow	—
			Square	—	—	EB3P-LUN3B-*		
			Rectangular w/Metal Bezel	—	—	EB3P-LUN4-*		
			Dome w/Diecast Sleeve	—	—	EB3P-LAD1-*		
	ø22	TW	Flush	—	—	EB3P-LAW1-*		
			Flush (Marking Type)	—	—	EB3P-LAW1B-*		
			Dome	—	—	EB3P-LAW2-*		
			Square Flush (Marking Type)	—	—	EB3P-LUW1B-*		
		HW	Round Flush	—	—	EB3P-LHW1-*		
			Dome	—	—	EB3P-LHW2-*		
			Square Flush	—	—	EB3P-LHW4-*		
		LW	Round	—	—	EB3P-LLW1-*		
			Square	—	—	EB3P-LLW2-*		
Miniature Pilot Light	ø10	UP	Extended	—	—	IPL1-18-*	A: Amber G: Green R: Red W: White Y: Yellow	—
			Dome	—	—	IPL1-19-*		
	ø8		Flush	—	—	IPL1-87-*		
			Extended	—	—	IPL1-88-*		
			Dome	—	—	IPL1-89-*		
	ø6		Flush	—	—	IPL1-67-*		
			Extended	—	—	IPL1-68-*		
			Dome	—	—	IPL1-69-*		

1. Codes N, TW, HW, LW, and UP are the series names of IDEC's control units.
2. Specify a color code in place of *.
3. Illuminated selector switches have a knob operator.
4. Above parts are recommended for EB3L barriers. However, none of these parts are UL recognized.

Pilot Lights, Illuminated Pushbuttons, Illuminated Selector Switches, and Buzzers, con't

Unit	Size	Series [1]	Shape	Operation Mode	Contact	Ordering Number [2]	Lens Color/ Illumination Color Code*	Operation
Illuminated Pushbutton	ø30	N	Extended	Momentary	1NO-1NC	EB3P-LBAN211-*	A: Amber G: Green R: Red S: Blue W: White Y: Yellow	—
				Maintained	1NO-1NC	EB3P-LBAON211-*		
			Mushroom	Pushlock Turn Reset	1NO-1NC	EB3P-LBAVN311-R	Red only	
	ø22	TW	Extended	Momentary	1NO-1NC	EB3P-LBAW211-*	A: Amber G: Green R: Red S: Blue W: White Y: Yellow	
				Maintained	1NO-1NC	EB3P-LBAOW211-*		
			Mushroom	Pushlock Turn Reset	1NO-1NC	EB3P-LBAVW411-R	Red only	
		HW	Round	Momentary	1NO	EB3P-LBH1W110-*	A: Amber G: Green R: Red S: Blue W: White Y: Yellow	
				Maintained	1NO	EB3P-LBHA1W110-*		
		LW	Round	Momentary	DPDT	EB3P-LBL1W1C2-*		
				Maintained	DPDT	EB3P-LBLA1W1C2-*		
			Square	Momentary	DPDT	EB3P-LBL2W1C2-*		
				Maintained	DPDT	EB3P-LBLA2W1C2-*		
Illuminated Selector Switch [3]	ø30	N	Round	2-position	1NO-1NC	EB3P-LSAN211-*		Maintained
				3-position	2NO	EB3P-LSAN320-*		Maintained
	ø22	TW	Round	2-position	1NO-1NC	EB3P-LSAW211-*		Maintained
				2-position, return from right	1NO-1NC	EB3P-LSAW2111-*		Spring return from right
				3-position	2NO	EB3P-LSAW320-*		Maintained
				3-position, return from right	2NO	EB3P-LSAW3120-*		Spring return from right
				3-position, return from left	2NO	EB3P-LSAW3220-*		Spring return from left
				3-position, 2-way return	2NO	EB3P-LSAW3320-*		2-way spring return
		HW	Round	2-position	1NO-1NC	EB3P-LSHW211-*		Maintained
				3-position	2NO	EB3P-LSHW320-*		Maintained
		LW	Round	2-position	DPDT	EB3P-LSL1W2C2-*		Maintained
Buzzer	ø30	—	—	Continuous sound	—	EB3P-ZUN12C	—	
				Intermittent sound	—	EB3P-ZUN12F	—	

1. Codes N, TW, HW, LW, and UP are the series names of IDEC's control units.
2. Specify a color code in place of *.
3. Illuminated selector switches have a knob operator.
4. Above parts are recommended for EB3L barriers. However, none of these parts are UL recognized.

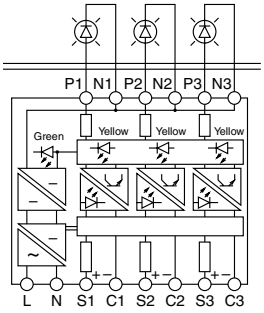
Accessory

Name	Ordering Number	Package Quantity	Remarks
LED Lamp	EB9Z-LDS1-*	1	Specify a color code in place of * in the Ordering No. A: amber, G: green, R: red, S: blue, W: white, Y: yellow

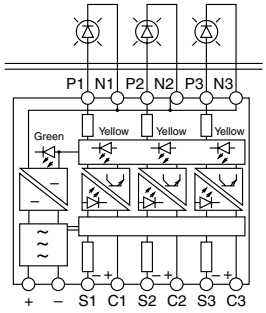
Above part is recommended for EB3L barriers. However, this part is not UL recognized.

Internal Circuit Block Diagram

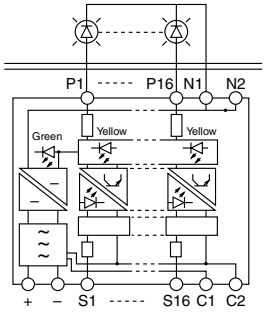
AC Power Source Input

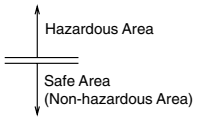


DC Power Sink Input



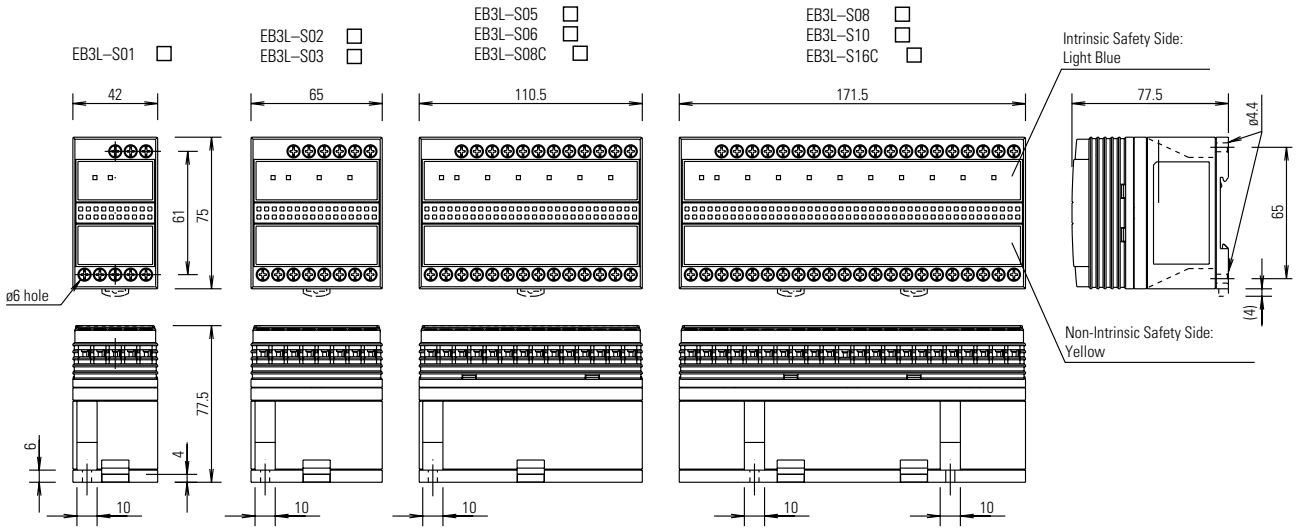
Connector Wiring Source Input



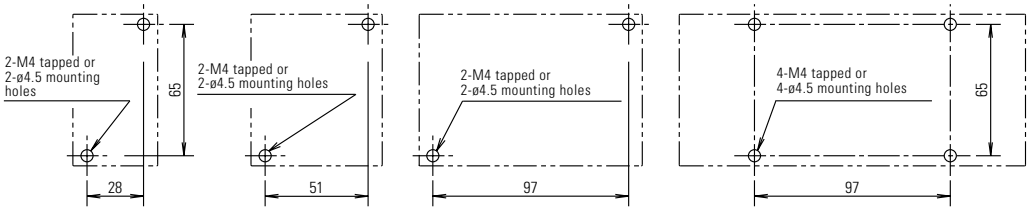


Dimensions (mm)

Terminal

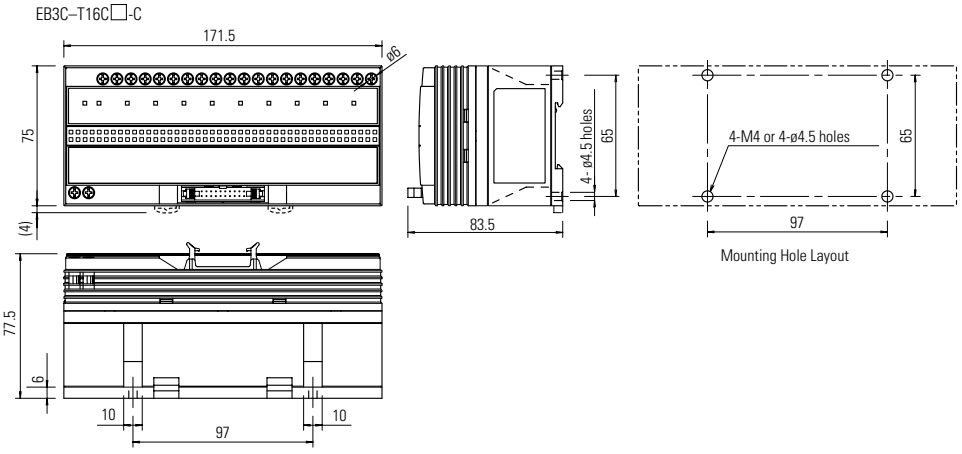


Mounting Hole Layout (Screw Mounting)

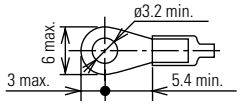


Connector

EB3C–T16C□-C

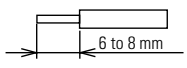


Applicable Crimping Terminal



Stripping the Wire End

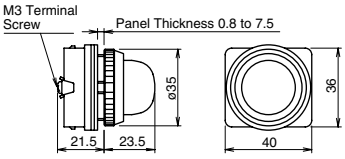
Solid Wire



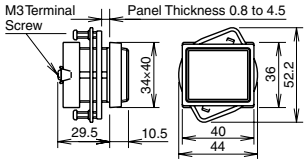
Stranded Wire (Ferrule)

Pilot Lights

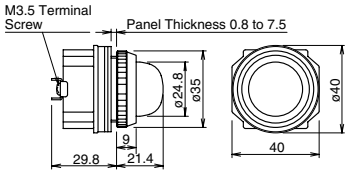
EB3P-LAN1
Terminal Cover: APN-PVL
(sold separately)



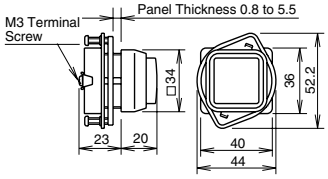
ø30 EB3P-LUN4
Terminal Cover: APN-PVL
(sold separately)



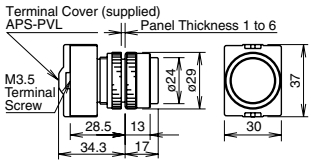
ø30 EB3P-LAD
Terminal Cover: APD-PVL
(sold separately)



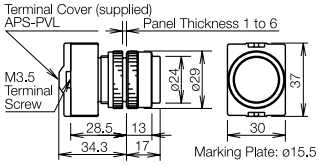
ø30 EB3P-LUN3B
Terminal Cover: APN-PVL
(sold separately)



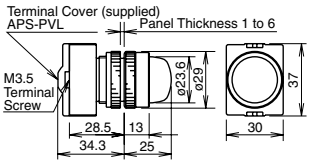
ø22 EB3P-LAW1



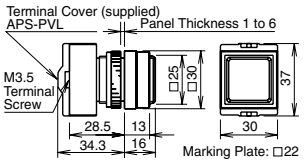
ø22 EB3P-LAW1B



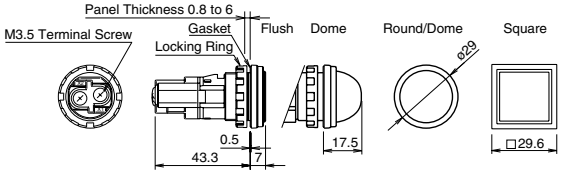
ø22 EB3P-LAW2



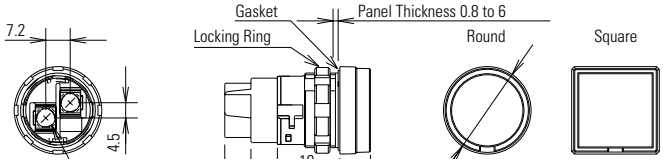
ø22 EB3P-LUW1B



ø22 EB3P-LHW1/EB3P-LHW2/EB3P-LHW4
Terminal cover attached.

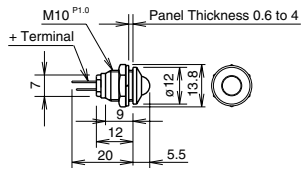


ø22 EB3P-LLW1/EB3P-LLW2/EB3P-LLW3
Terminal cover attached.

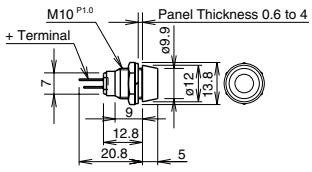


Miniature Pilot Lights (Terminal cover not available)

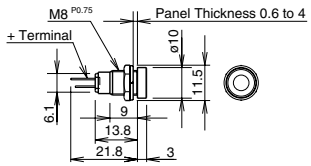
ø10 IPL1-18



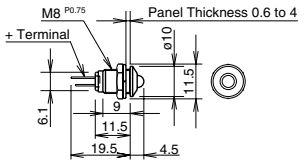
ø10 IPL1-19



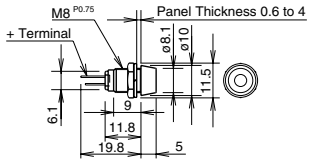
ø10 IPL1-87



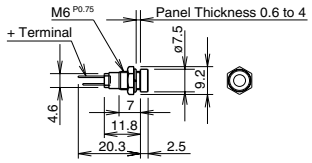
ø10 IPL1-88



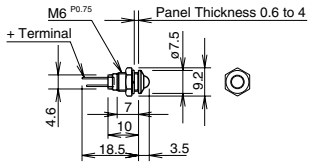
ø8 IPL1-89



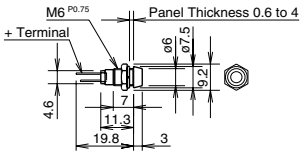
ø8 IPL1-67



ø8 IPL1-68

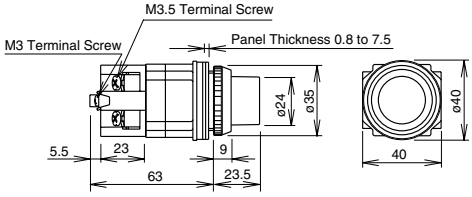


ø8 IPL1-69

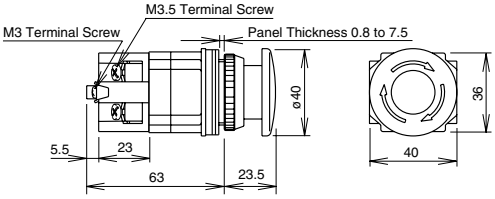


Illuminated Pushbuttons

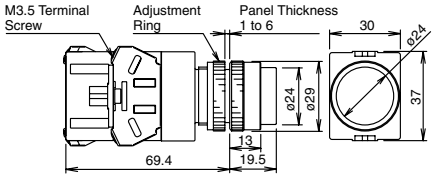
ø30 EB3P-LBAN211/LBA0N211
Terminal cover: N-VL4 (2 pcs.) (sold separately)



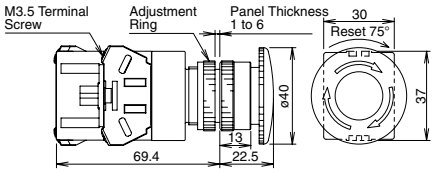
ø30 EB3P-LBAVN311-R
Terminal cover: N-VL4 (2 pcs.) (sold separately)



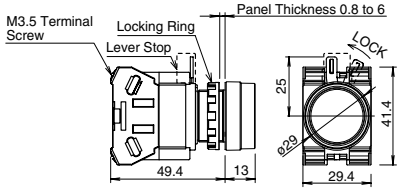
ø22 EB3P-LBAW211/LBA0W211
Terminal cover attached.



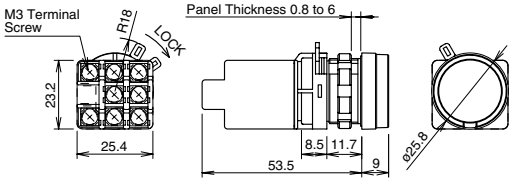
ø22 EB3P-LBAVW411-R
Terminal cover attached.



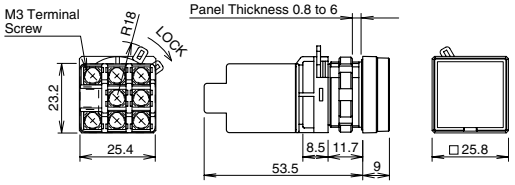
ø22 EB3P-LBH1W110/LBHA1W110
Terminal cover attached.



ø22 EB3P-LBL1W1C2/LBLA1W1C2
Terminal cover: LW-VL2M (sold separately)



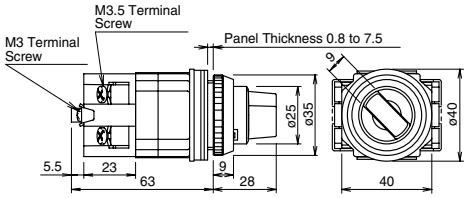
ø22 EB3P-LBL2W1C2/LBLA2W1C2
Terminal cover: LW-VL2M (sold separately)



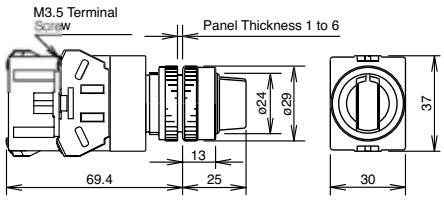
All dimensions in mm.

Illuminated Selector Switches

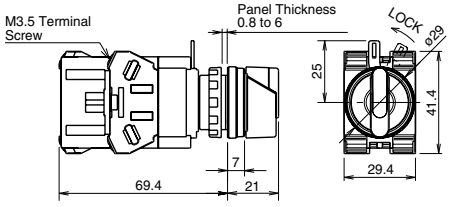
ø30 EB3P-LSAN211/EB3P-LSAN320
Terminal cover: N-VL4 (2 pcs.) (sold separately)



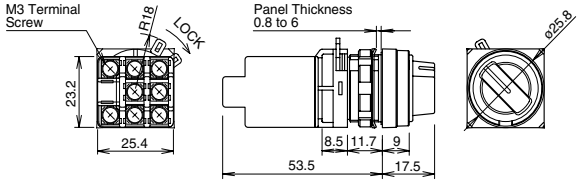
ø22 EB3P-LSAW***
Terminal cover attached



ø22 EB3P-LSHW211/EB3P-LSHW320
Terminal cover attached

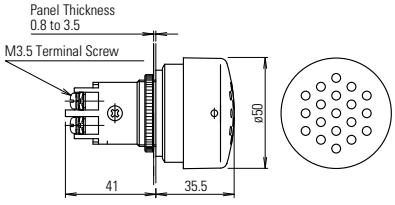


ø22 EB3P-LSL1W2C2/EB3P-LSL3W3C2
Terminal cover: LW-VL2M (sold separately)

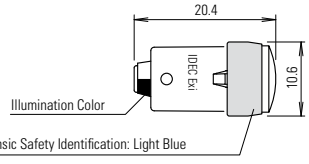


Buzzer

ø30 EB3P-ZUN12C/ZUN12F
Terminal cover: AZ-VL5 (sold separately)



ø30 EB9Z-LDS1



Illumination color is marked on the terminal.

Polarity Identification

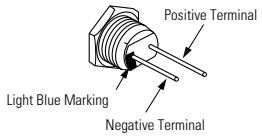
Pilot Lights/Illuminated Pushbuttons/Illuminated Selector Switches

Positive terminal: X1
Negative terminal: X2

Miniature Pilot Lights

Positive terminal: Long pin terminal
Negative terminal: Short pin terminal

Pin Terminals

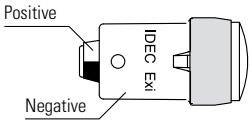


A light blue marking is indicated on the negative terminal side to identify intrinsically safe usage.

Buzzer

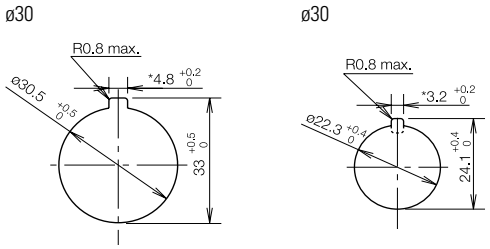
Positive terminal: +
Negative terminal: –

LED Lamp

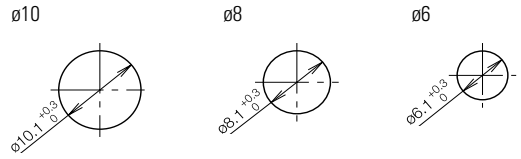


Panel Cut-out

Pilot Lights/Illuminated Pushbuttons/Illuminated Selector Switches/Buzzers



Miniature Pilot Lights

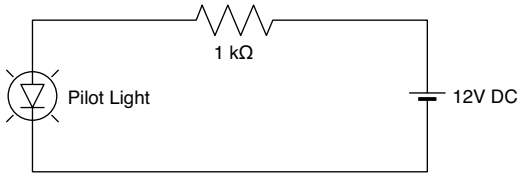


* The 4.8 or 3.2 recess is needed only when using an anti-rotation ring or a nameplate with an anti-rotation projection.
EB3P-LHW does not have an anti-rotation groove.

All dimensions in mm.

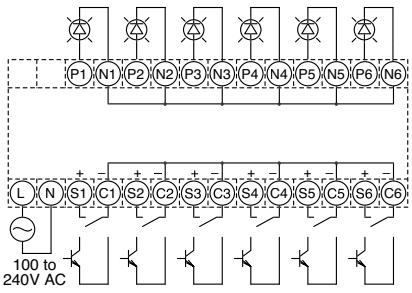
Lamp Test

When checking the lamp lighting without using the EB3L lamp barrier, first make sure that the atmosphere is free from explosive gases. Connect a 12V DC power supply and a protection resistor of 1 kΩ in series to turn on the pilot light.

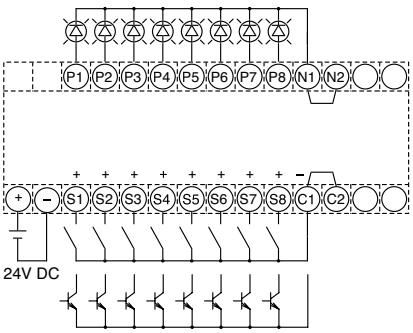


Non-intrinsically Safe External Input Wiring Examples

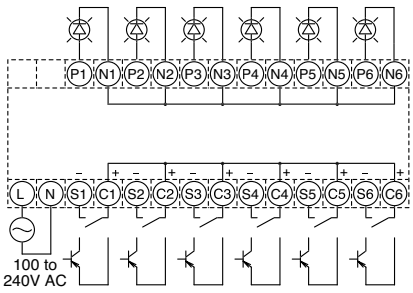
6-channel Source
(Ex.: EB3L-S06SA)



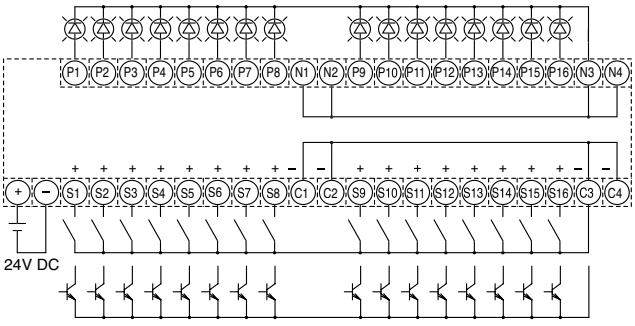
8-channel Common Wiring, Source
(Ex.: EB3L-S08CSD)



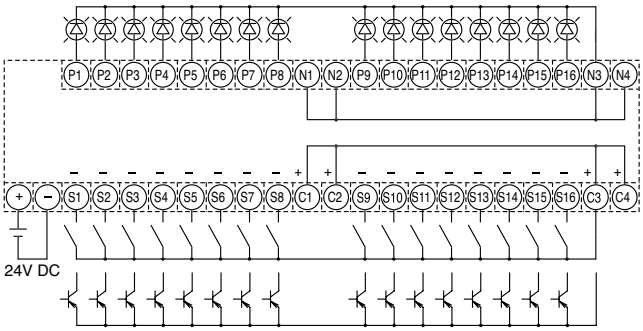
6-channel Sink
(Ex. EB3L-S06KA)



16-channel Common Wiring, Source
(Ex.: EB3L-S16CSD)

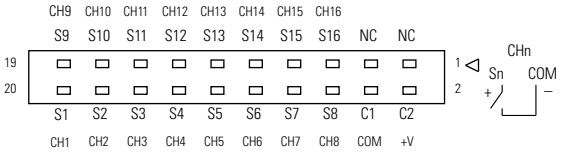


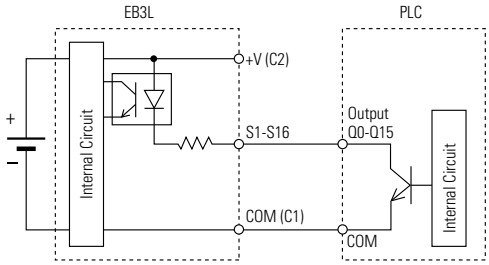
16-channel Common Wiring, Sink
(Ex.: EB3L-S16CKD)



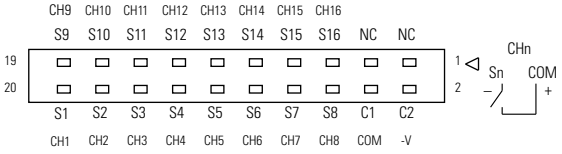
Connector Wiring Terminal Arrangement

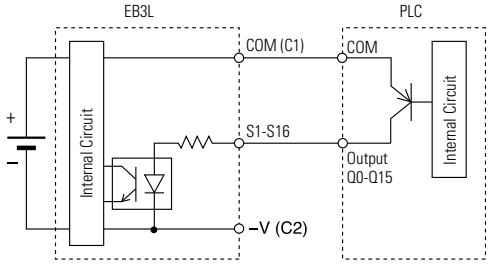
EB3L-S16CSD-C





EB3L-S16CKD-C





FC4A-T16K3		EB3L-S16CSD-C	
Terminal	Output	Input	Terminal
20	Q0	S1	20
19	Q10	S9	19
18	Q1	S2	18
17	Q11	S10	17
16	Q2	S3	16
15	Q12	S11	15
14	Q3	S4	14
13	Q13	S12	13
12	Q4	S5	12
11	Q14	S13	11
10	Q5	S6	10
9	Q15	S14	9
8	Q6	S7	8
7	Q16	S15	7
6	Q7	S8	6
5	Q17	S16	5
4	COM	COM	4
3	COM	NC	3
2	+V	+V	2
1	+V	NC	1

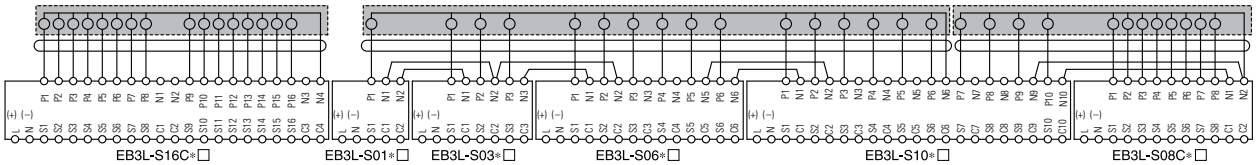
FC4A-T16S3		EB3L-S16CKD-C	
Terminal	Output	Input	Terminal
20	Q0	S1	20
19	Q10	S9	19
18	Q1	S2	18
17	Q11	S10	17
16	Q2	S3	16
15	Q12	S11	15
14	Q3	S4	14
13	Q13	S12	13
12	Q4	S5	12
11	Q14	S13	11
10	Q5	S6	10
9	Q15	S14	9
8	Q6	S7	8
7	Q16	S15	7
6	Q7	S8	6
5	Q17	S16	5
4	COM	COM	4
3	COM	NC	3
2	–V	–V	2
1	–V	NC	1

Note: The wiring in dashed line does not affect the operation of the EB3L.
Applicable connector is IDEC's JE1S-201.
Output power for PLC outputs is supplied by the EB3L, therefore the PLC output does not need an external power supply.

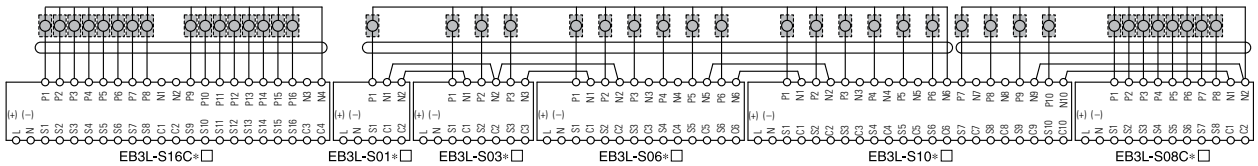
Wiring Example of Intrinsically Safe External Outputs

1. Common Wiring (Maximum 16 circuits) (Buzzers cannot be wired in a common line.)*

All output lines are wired to a common line inside the intrinsically safe equipment (one common line per intrinsically safe circuit) - DC input models only.

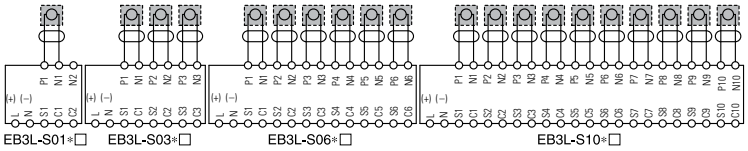


All input lines are wired to a common line outside the intrinsically safe equipment (one common line per intrinsically safe circuit).



2. Separate Wiring

Each output line of the EB3L makes up one independent intrinsically safe circuit of a pilot light or buzzer.

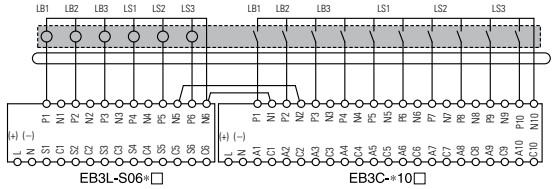


Note:
When using two or more EB3L's to set up one intrinsically safe circuit in the common wiring configuration, interconnect two neutral terminals (N1 through N10) on each EB3L between adjacent EB3L's in parallel.

3. Wiring Illuminated Pushbuttons and Illuminated Selector Switches

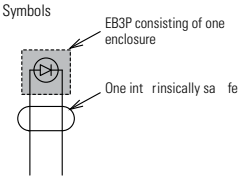
(A maximum of 16 channels of EB3L and EB3C can be wired to a common line.)

The following example illustrates the wiring for a total of 10 contacts used by three illuminated pushbuttons (LB1 to LB3) and three illuminated selector switches (LS1 to LS3).



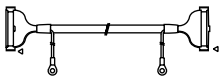
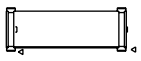
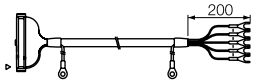
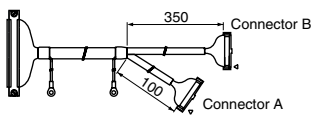
*This is permitted under TIIS approvals

Diagram Symbols

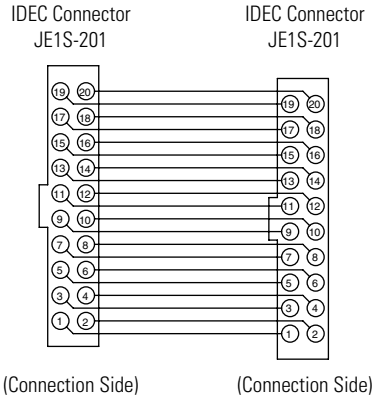


One intrinsically safe circuit is a connection consisting of one or more illuminated units connected to a common line.

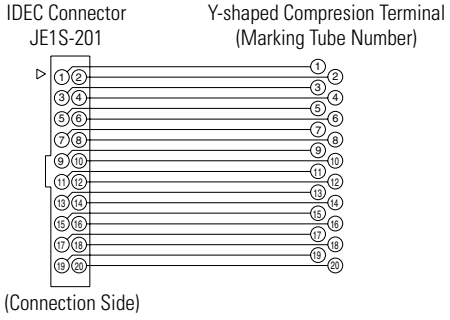
Recommended Connector Cable for Connector Types

Description		No. of Poles	Length (m)	Part Number	Shape	Applicable Type
I/O Terminal Cable	With Shield	20	0.5	FC9Z-H050A20		IDEC MicroSmart I/O Module
			1	FC9Z-H100A20		
			2	FC9Z-H200A20		
			3	FC9Z-H300A20		
	Without Shield		0.5	FC9Z-H050B20		IDEC MicroSmart I/O Module
			1	FC9Z-H100B20		
			2	FC9Z-H200B20		
			3	FC9Z-H300B20		
Cable with Crimping Terminal			1	BX9Z-H100E4		Screw Terminal
			2	BX9Z-H200E4		
			3	BX9Z-H300E4		
40-pin Cable for PLC			1	BX9Z-H100B		Mitsubishi A Series Output Module (sink) ↓ EB3L-S16CSD-C
			2	BX9Z-H200B		
			3	BX9Z-H300B		

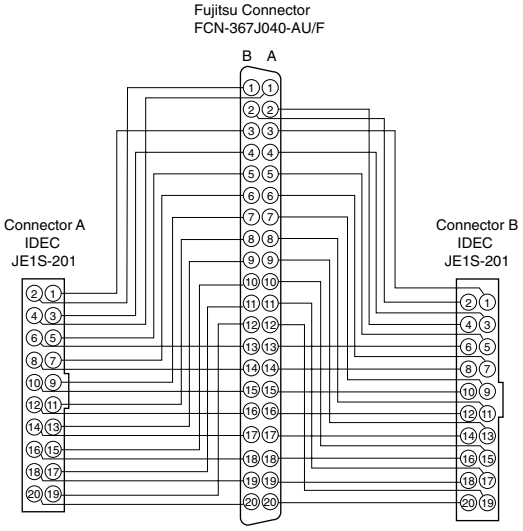
FC9Z-H□□□A, FC9Z-H□□□B Internal Connection



FC9Z-H□□□ E4 Internal Connection



BX9Z-H□□□B Internal Connection



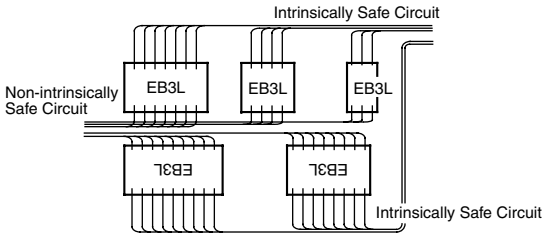
Precautions for Operation

Installation of EB3L Lamp Barriers

1. The EB3L can be installed in any direction.
2. Install the EB3L lamp barrier in a safe area (non-hazardous area) in accordance with intrinsic safety ratings and parameters. To avoid mechanical shocks, install the EB3L in an enclosure which suppresses shocks.
3. When installing or wiring the EB3L, prevent electromagnetic and electrostatic inductions in the intrinsically safe circuit. Also prevent the intrinsically safe circuits from contacting with another intrinsically safe circuit and any other circuits.

   Maintain at least 50 mm clearance, or provide a metallic separating board between the intrinsically safe circuit and non-intrinsically safety circuit. When providing a metallic separating board, make sure that the board fits closely to the enclosure (top, bottom, and both sides). Allowable clearance between the enclosure and board is 1.5 mm at the maximum.

   The clearance of 50 mm between the intrinsically safe circuit and non-intrinsically safe circuit may not be sufficient when a motor circuit or high-voltage circuit is installed nearby. In this case, provide a wider clearance between the circuits referring to 6. (3) "Minimum Parallel Distance between the Intrinsically Safe Circuit and Other Circuits."
4. In order to prevent contact between intrinsically safe circuits and non-intrinsically safe circuits, mount EB3L units with terminals arranged in the same direction.



5. Maintain at least 6 mm (or 3 mm according to IEC60079-11: 1999) clearance between the terminal of intrinsically safe circuit and the grounded metal part of a metal enclosure, and between the relay terminal block of an intrinsically safe circuit and the grounded metal part of a metal enclosure.
6. For installing the EB3L, mount on a 35-mm-wide DIN rail or directly on a panel using screws. The EB3L can be installed in any direction. Make sure to install securely to withstand vibration. When mounting on a DIN rail, push in the clamp completely. Use the BNL6 end clips on both sides of the EB3L to prevent from moving sideways.
7. Excessive extraneous noise may cause malfunction and damage to the EB3L. When extraneous noise activates the voltage limiting circuit (thyristor), remove the noise source and restore the power.

Terminal Wiring

1. Using a ø5.5 mm or smaller screw driver, tighten the terminal screws (including unused terminal screws) to a torque of 0.6 to 1.0 N·m (recommended value).
2. Make sure that IP20 is achieved when wiring. Use insulation tubes on bare crimping terminals.
3. To prevent disengaged wires from contacting with other intrinsically safe circuits, bind together the wires of one intrinsically safe circuit.
4. When the adjacent terminal is connected to another intrinsically safe circuit, provide an insulation distance of at least 6 mm.

Signal Input

1. Connect the EB3L to the switches or output equipment which have a low leakage current (0.1 mA maximum).
2. The EB3L is equipped with power supply. Do not apply external power to the EB3L.
3. When connecting the EB3L's of connector type in parallel, make sure that the same power supply is used. When using C1 and C2 terminals to supply power to outside equipment, maintain the current at 50 mA maximum.

Power Voltage

1. Do not apply an excessive power voltage, otherwise the EB3L may be damaged.
2. The EB3L of AC power type may operate at a low voltage (approx. 20V).

Pilot Lights and Buzzers in the Hazardous Area

1. EB3P and IPL1 units shown on page 238 can be used with the EB3L. Buzzers cannot be connected in common wiring.
2. Install the EB3P and IPL1 units on enclosures of IP20 or higher protection. Use a metallic enclosure with magnesium content of 7.5% or less (steel and aluminum are acceptable).
3. When wiring, make sure of correct polarities of the EB3P and IPL1.
4. Certification mark is supplied with the units. Attach it on the visible area of the EB3P or IPL1 (for Japan application).
5. EB3P (except for buzzers) and IPL1 illuminated units, which are simple apparatuses in accordance with relevant standards of each country, can be installed in the hazardous area and connected to the EB3L located in the safe area.
6. When connecting illuminated switches to the EB3L lamp barrier and the EB3C relay barrier, a maximum of 16 channels can be connected in common wiring.

Wiring for Intrinsic Safety

1. The voltage applied on the general circuit connected to the non-intrinsically safe circuit terminals of the EB3L lamp barrier must be 250V AC, 50/60Hz (UL rating: 125V AC 50/60Hz), or 250V DC (UL rating: 125V DC) at the maximum under any conditions, including the voltage of the power line and the internal circuit.
2. When wiring, take into consideration the prevention of electromagnetic and electrostatic charges on intrinsically safe circuits. Also, prevent intrinsically safe circuits from contacting with other circuits.
3. The intrinsically safe circuits must be separated from non-intrinsically safe circuits. Contain intrinsically safe circuits in a metallic tube or duct, or separate the intrinsically safe circuits referring to the table at right.

Note: Cables with a magnetic shield, such as a metallic sheath, prevent electromagnetic induction and electrostatic induction, however, a non-magnetic shield prevents electrostatic induction only. For non-magnetic shields, take a preventive measure against electromagnetic induction.

Finely twisted pair cables prevent electromagnetic induction. Adding shields to the twisted pair cables provides protection against electrostatic induction.

Voltage and Current of Other Circuits	Over 100A	100A or less	50A or less	10A or less
Over 440V	2000	2000	2000	2000
440V or less	2000	600	600	600
220V or less	2000	600	600	500
110V or less	2000	600	500	300
60V or less	2000	500	300	150

Note: Above chart is applicable under TIIS standards only.

Minimum Parallel Distance between the Intrinsically Safe Circuit and Other Circuits (mm)

1. When identifying intrinsically safe circuits by color, use light blue terminal blocks and cables.
2. When using two or more EB3L's to set up one intrinsically safe circuit in the common wiring configuration, interconnect two neutral terminals (N1 through N10) on each EB3L between adjacent EB3L's in parallel.
3. Make sure that the power of the EB3L, pilot lights, and other connected units are turned off before starting inspection or replacement.
4. When wiring the intrinsically safe circuit, determine the distance to satisfy the wiring parameters shown below. Note that parameters are different between separate wiring and common wiring and depend on the connected units, such as pilot lights, illuminated pushbuttons, and buzzers.

   a) Wiring capacitance Cw ≤ Co – Ci
   Co: Maximum external capacitance of the EB3L
   Ci: Internal capacitance of the connected unit

   b) Wiring inductance Lw ≤ Lo – Li
   Lo: Maximum external inductance of the EB3L
   Li: Internal inductance of the connected unit

   c) Wiring resistance ≤ Rw
   Rw: Allowable wiring resistance

   d) Allowable wiring distance D (km) is the smallest value of those calculated from the capacitance, inductance, and resistance.

   D ≤ Cw/C C (nF/km): Capacitance of cable per km
   D ≤ Lw/L L (mH/km): Inductance of cable per km
   D ≤ Rw/2R R (Ω/km): Resistance of cable per km

Note: For the details of wiring the intrinsically safe circuits, refer to a relevant test guideline for explosion-proof electric equipment in each country.

Safety Precautions

Do not use the EB3C Relay Barrier and EB3L Lamp Barrier for other than explosion protection purposes.

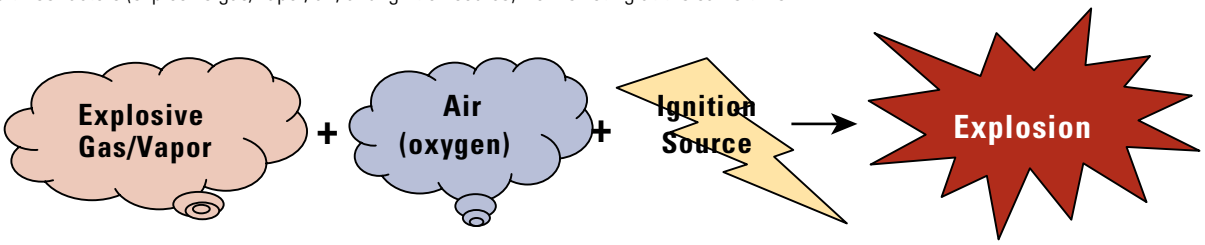
Read the user's manual to make sure of correct operation before starting installation, wiring, operation, maintenance, and inspection of the EB3C Relay Barrier and EB3L Lamp Barrier.

General Information

What is Explosion Protection?

Explosion Mechanism

For an explosion to occur, both hazardous atmosphere (mixture of explosive gas/vapor and air) and ignition source from electrical equipment must exist. The first step for explosion prevention is to prevent the three factors (explosive gas/vapor, air, and ignition source) from existing at the same time.



Ignition source: Electrical equipment which originates electrical sparks or has a high temperature, capable of causing ignition in a hazardous atmosphere.

Explosion protection types:

1. Separation of explosive gas/vapor and ignition source
   → Flameproof explosion protection
   → Pressurized explosion protection

2. Low power on ignition source → Intrinsically safe explosion protection

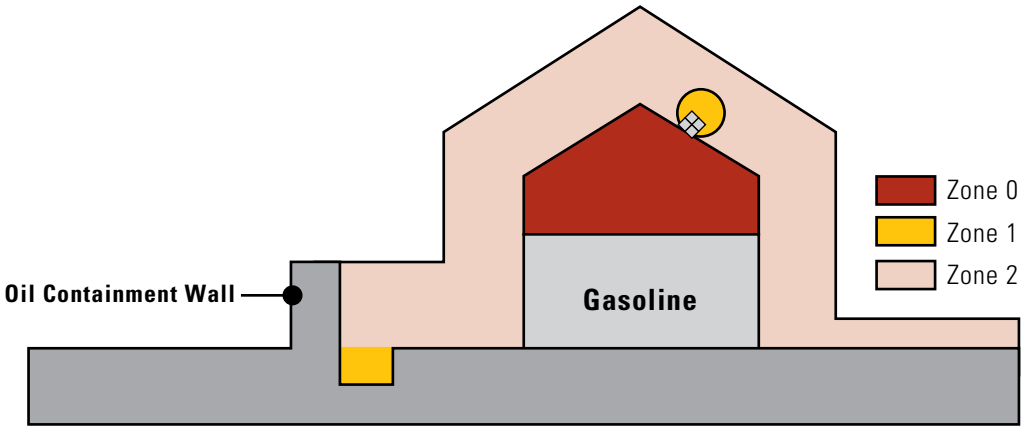
Classification of Hazardous Areas

- Required when selecting explosion protection electrical equipment and wiring methods.
- Determined by user.
- Hazardous areas are classified depending on the frequency of the occurrence of hazardous atmosphere.

IEC Classification

Zone 0: Where hazardous atmosphere may exist for 1,000 hours or longer per year.
Zone 1: Where hazardous atmosphere may exist for 10 to 1,000 hours per year.
Zone 2: Where hazardous atmosphere may exist for less than 1 hour per year.

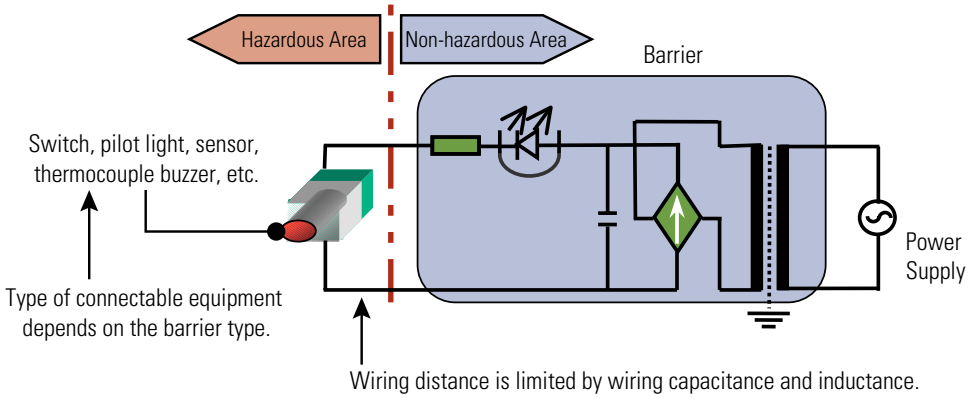
Gasoline Tank Example



Explosion Protection Types

Intrinsically Safe Structure

- Structure in which voltage and current are limited so that no sparks, arc, and thermal effect produced by electric equipment (switch, pilot light, etc) in hazardous areas are capable of causing ignition of explosive gas/vapor.


Hazardous Area
Non-hazardous Area
Barrier
Switch, pilot light, sensor, thermocouple buzzer, etc.
Type of connectable equipment depends on the barrier type.
Power Supply
Wiring distance is limited by wiring capacitance and inductance.

Features:

- Barrier is installed in non-hazardous area, and is connected to the switches or pilot lights in hazardous area.
- The intrinsically safe system can be used in zone 0.
- Because voltage and current to the electric equipment are limited, the variety of devices that can be connected to the barrier is restricted.
- Wiring is required between hazardous and non-hazardous areas.
- Grounding (grounding resistance 10Ω max.) may be required (EB3C, EB3L do not require grounding).

Grounding - The procedure to achieve required resistance value by inserting a grounding wire into a hole in the ground and furnishing the surrounding with material of superior electrical conductivity.

Non-insulated barrier (Zener barrier): grounding resistance 10Ω max.

- While the voltage difference between the circuits is limited in Zener barriers, the voltage difference between the circuits and grounding is unlimited. When a short-circuit occurs between the circuits and ground, high voltage/current may be generated in the circuits, causing a possible explosion. The 0V line of circuits, therefore, must be provided with grounding (resistance 10Ω max.) so that the voltage/current can be shunted to the ground.

Insulated barrier: grounding resistance 100Ω max.

- Intrinsically safe and non-intrinsically safe parts are electrically isolated by an isolation transformer. If a sufficient isolation distance is not provided on the isolation transformer, however, the transformer may short-circuit between primary and secondary when an abnormal voltage occurs. This may generate high voltage/current in the intrinsically safe circuit, causing a possible explosion. A transformer with metallic isolator must be used between primary and secondary, and grounding (resistance 100Ω max.) must be provided.

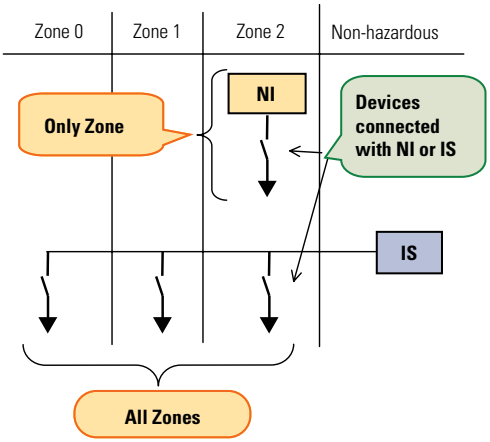
Difference between NI (Non-incendive) & IS (Intrinsic Safety)

Standard

- NI: Installed in areas that are Zone 2 hazardous locations.
- IS: Installed in areas that are non-hazardous.

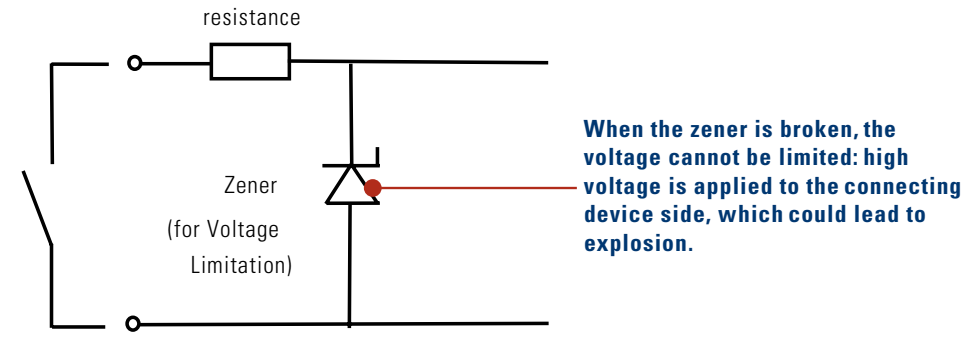
Advantages & Disadvantages

- NI: Small and inexpensive. Devices connected with NI are also installed only in the Zone 2 area.
- IS: Small but more expensive. Devices connected with IS can be used in the Zone 0, 1 and 2 areas (all zones).

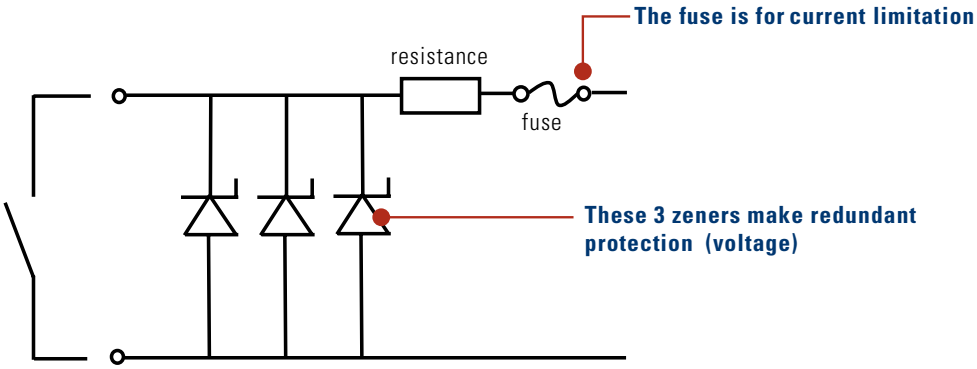


Structure

NI Structure


resistance
Zener
(for Voltage
Limitation)
When the zener is broken, the voltage cannot be limited: high voltage is applied to the connecting device side, which could lead to explosion.

IS Structure



Note : Instead of zeners, thyristors are used in EB3C for better energy effeciency.

Explosion Protection Marking

Gas is categorized into groups by explosiveness and ignition temperature.

Technical standard: Determines the gas type which can be used with the apparatus.

Ex ia IIC T6

Temperature: maximum surface temperature of electrical equipment

T1:	450°C
T2:	300°C
T3:	200°C
T4:	135°C
T5:	100°C
T6:	85°C

Electrical Equipment:

IIA:	Applicable to group IIA gas
IIB:	Applicable to groups IIA and IIB gasses
IIC:	Applicable to groups IIA, IIB, and IIC gasses

Explosion Protection:

d:	Flameproof type
e:	Increased safety type
p:	Pressurized type
ia, ib:	Intrinsic safety type
de:	Flameproof and increased safety type
d(ia):	Intrinsic safety and flameproof type

Shows compliance with the standard

Examples: ExdeIIBT4, EXeIICT4, ExpIIBT4, ExiaIICT5

EB3C/EB3L Features

Small and lightweight

EB3C (10-circuit)	Weight: Dimensions:	380g 171.5 L × 75 W × 77.5 H (mm)	• Plastic housing • Small system design
EB3L (10-circuit)	Weight: Dimensions:	360g 171.5 L × 75 W × 77.5 H (mm)	

No grounding required: less labor, less cost

No explosion protection grounding.

Isolation transformer is used. All isolations – not only between primary and secondary, but also cores and bobbins – are reinforced.

↓

No isolator = No grounding

No electrical equipment grounding.

Power supply part:	Electric shock is prevented with reinforced isolation. Conforms to IEC standard.
Output part:	The small power & EMC design requires no grounding. Conforms to IEC switch output standard.

Shield wire treatment
Shield wires of intrinsically safe circuits are grounded to the panel in non-hazardous area, and not connected to the N terminal on the barrier.

Common Type and Connector Type

1. Common type → For 8 and 16 circuits. Easy connection to PLC.
2. Connector type
   - Flat cable connection between non-intrinsically safe part and PLC.
   - Connectable to IDEC's FC5A, FC4A and Mitsubishi's AIS.

Standards

1. CE
   Conforms to EMC directive and LVD.
   EMC directive:
   Electromagnetism generated by the barrier does not affect other communication equipment. Also, electromagnetism generated by other communication equipment does not affect the barrier.
   LVD (Low Voltage Directive):
   For rated voltages 50 to 1000V AC, 75 to 1500V DC.
2. ATEX
   Adopted by EU, this directive covers electrical and mechanical equipment and protective systems, which may be used in potentially explosive atmospheres (Europe). EN50014 series is adopted.
3. FM (Factory Mutual Approval)
   A private US certification organization for waterproof and intrinsic safety. Widely recognized for more intrinsic safety than UL.
4. CSA (Canadian Standards Association)
   A Canadian certification organization for electrical equipment.
5. NK: Class NK (Nippon Kaiji Kyokai)
   Required for ships with Japanese ship registration.
6. Underwriters Laboratories (UL) - A US certification agency for all electrical and hazardous location products.

Less labor

1. Finger-safe spring-up terminal
   The finger-safe, captive spring-up terminals prevent electric shock (IP20), and make installation easy. No screw loss.
2. Universal voltage
   100 to 240V AC (UL rating 100 ~ 120VAC).
3. Installation
   Direct and DIN-rail mountable.

EB3 series: Screws cannot be touched by fingers even when loosened.

Switches connectable to EB3C

Switches which are configured only with mechanical contacts (dry contacts) can be connected to the EB3C.

Pushbutton, selector, cam, toggle, limit, micro, reed, foot, pressure, and temperature switches can be used.

Note: Contact rating must be 13.2V, 14.2 mA minimum. Contact material such as silver oxide cadmium and silver tungsten may cause conduction failure at 10 mA due to the film generated on the surface.

Equipment connectable to EB3L

Common wiring: Only EB3P-L type pilot lights, which have been approved, can be connected to the EB3L lamp barrier.

Separate wiring: No approval is required for pilot lights and buzzers to be connected to the EB3L lamp barrier. However, users must make sure that the temperature rise of the equipment is below the rated value with the current and voltage supplied from the relay barrier. Also take the ratings of intrinsically safe circuit into consideration. IDEC's EB3P-L type pilot light lights and EB3P-Z type buzzers satisfy the ratings.

EB3P-L Pilot light: ø22 and ø30, a total of 78 types

- Super LED installed
- Lens colors: amber, blue, green, red, white, and yellow
- Accessories and maintenance parts are the same as standard control units. See IDEC's control units catalogs.

ø30: APN, UPQN equivalent
ø22: APW, HW,LW,UPQW equivalent

IPL1 Miniature pilot light: ø6, ø8, and ø10, a total of 40 types

- Low price
- Illumination colors: amber, green, red, white, and yellow

EB3P-Z buzzer: Continuous and intermittent sound, ø30 mounting hole, terminal block type

- Degree of protection: IP20
- Common wiring is not available due to high inductance value.
- Approved by TIIS only

When connecting one buzzer and 15 pilot lights to EB3L-S16CSD, do not connect the negative lines of buzzer and pilot lights in common. Connect the buzzer and pilot lights to the barrier using separate lines (15 pilot lights can be wired with one common line).

Connecting Illuminated Switches

Made possible with the combination of EB3L and EB3C.

User benefits

- Flexibility of control panel design
  Explosion protected panels can be designed in a similar manner to non-explosion protected panels (non-explosion protected panels can be used as explosion protected panels without any changes).
- Control panel becomes smaller.

Connectable illuminated switch: 134 types

EB3P-LB
Illuminated Pushbutton Switch
- ø30: ALN2 equivalent
- ø22: ALW2, HW, LW equivalent

EB3P-LS
Illuminated Selector Switch
- ø30: ASLN equivalent
- ø22: ASLW, HW, LW equivalent

Super LED installed.
Lens color: amber, blue, green, red, white, yellow

Connection Method

1. Difference between EB3C and EB3L

EB3C: ON/OFF output signals to other equipment.
→ Connection to PLC's inputs.

EB3L: ON/OFF input signals to pilot lights and buzzers.
→ Connection from PLC's outputs.

2. Sink and Source
   Available combination: Sink Output + Source Input or Source Output + Sink Input. Sink output (source input) is mainly adopted in Japan (Europe: source output).

Other information

- Up to 16 channels, including both pilot lights and contacts, can be connected in common wiring.
- Connect the common wires of pilot lights and contacts separately to the N terminals of each barrier.
- Use two wires to connect the common terminals (N terminals) EB3C and EB3L barriers.
- Accessories and maintenance parts are the same as the standard control units. See IDEC's control units catalogs for details.

Safety Precautions

Electrostatic protection: Prevention of fire ignition and explosion caused by electrostatic charges.

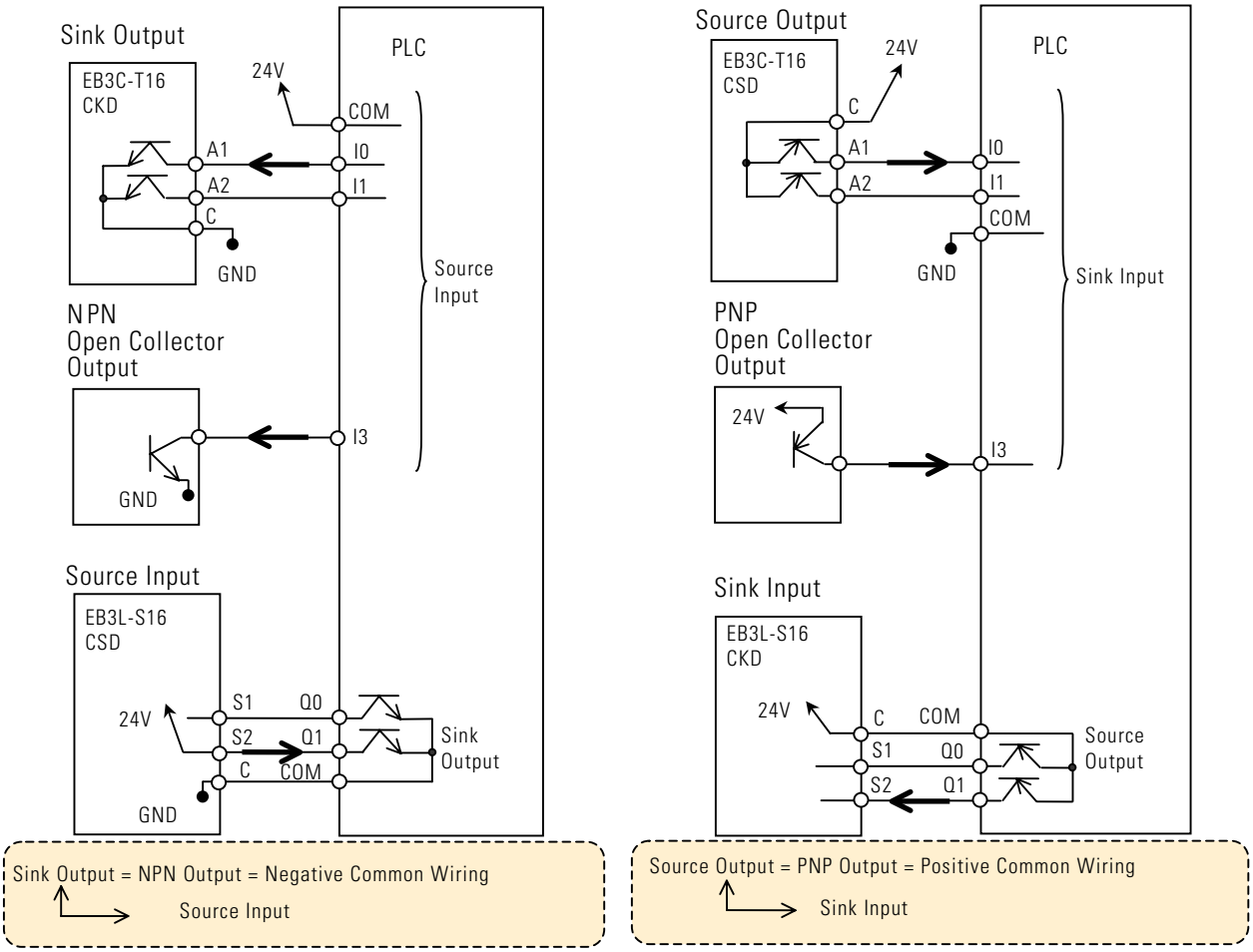
- As required by IEC60079-11, limit the exposed surface of plastic equipment (switch, pilot light) installed in hazardous areas.
- 20 cm^2 max. for IIC gas atmosphere.
- 100 cm^2 max. for IIB and IIA gas atmosphere.
- When the surface area of other than operating parts exceeds the limit, attach a caution plate.
- Pushbutton, knob, or other parts which are frequently touched by operators.

EB3C Separate and Common Types

1. Separate Wiring Type
   The output circuit is isolated for each channel. Both sink and source outputs can be connected.

2. Common Wiring Type
   The output circuit is not isolated from each other and uses common terminal C. Sink and source outputs are available on different modules.

Sink/Source Definition



Relay Terminal Block

When connecting a relay barrier to the switches and pilot lights installed in hazardous area to, use a relay terminal block.

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A relay terminal block can be eliminated when using EB3C and EB3L, as these barriers are considered as relay terminal blocks.

Cable Extension and Intrinsic Safety Parameter

- For wiring between the barrier and the switches and pilot lights installed in hazardous area, use a cable of 2.0 mm^2.
  The cable can be extended up to approximately 1 km.
- For EB3L of common wiring type, use a cable of 2.0 mm^2 . The cable can be extended up to approximately 600 m. Longer cables cause dim LED lighting.

Make sure that wiring parameters (inductance, capacitance, resistance) do not exceed the maximum limit.

Noise Countermeasure

- The LED connected to the EB3L may blink due to noises.
- Check the wiring so that noise is not imposed on the EB3L (eg. separation from power line).
- Noise can be avoided also by inserting a noise filter for AC line into the barrier's power input part.

Recommended noise filters:

DENSEI-LAMBDA		TDK	Schaffner
MBW-1202-22	PBF-1202-22	ZCB2203-11	FN670-3/06
MBW-1203-22	PBF-1203-22	ZCB2206-11	
MBW-1206-22	PBF-1206-22		